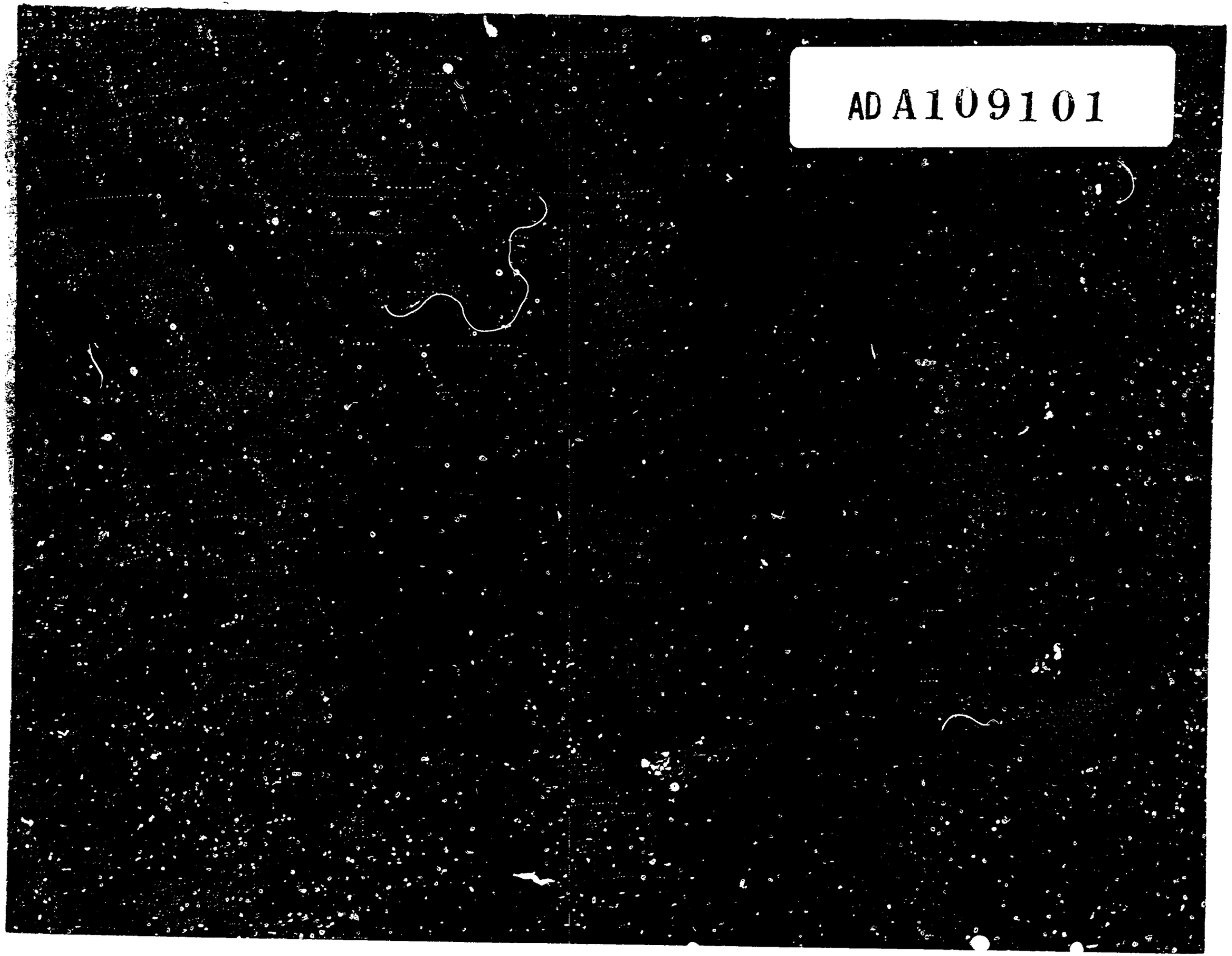
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DALTON RUN, LACKAWANNA COUNTY
PENNSYLVANIA

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GLENBURN POND DAM
NDI ID NO. PA-00371
DER ID NO. 35-1

NATURAL LANDS TRUST

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DACW31-81-C-0019

Prepared by

GEO-Technical Services, Inc.
Consulting Engineers & Geologists
851 S. 19th Street
Harrisburg, Pennsylvania 17104

For

Department of the Army
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

August 1981

DTIC ELECTE

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditor of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION
AND
RECOMMENDED ACTION

Name of Dam:	Glenburn Pond Dam NDI ID No. PA-00371 DER ID No. 35-1
Size:	Small (16.3 feet high; 263 acre-feet)
Hazard Classification:	High
Owner:	Natural Lands Trust 1339 Chestnut Street Philadelphia, Pennsylvania 19107 Attn: Lowell T. Young, Property Supervisor
State Located:	Pennsylvania
County Located:	Lackawanna
Stream:	Dalton Run
Date of Inspection:	May 14, 1981

Based on available records, past performance, visual inspection, field survey and calculations, the Glenburn Pond Dam is judged to be in poor condition. Based on the small size and the high hazard classification of the dam, the recommended Spillway Design Flood (SDF) varies between the one-half of the Probable Maximum Flood (1/2 PMF) and the full PMF. Because of the small storage capacity in the reservoir, the 1/2 PMF is selected as the SDF for Glenburn Pond Dam. The present spillway capacity of 464 cfs (cubic feet per second) can pass approximately 2% of the PMF. Overtopping analysis indicates overtopping depths of 1.9 feet and 5 feet during flood magnitudes of 0.1 PMF and 0.5 PMF, respectively. The duration of overtopping for the aforementioned floods is 8.5 and 11.75 hours, respectively. Failure of the dam would increase the downstream hazard to loss of life and property.

Based on the above assessment, the spillway is classified as seriously inadequate and the facility is rated unsafe, non-emergency.

The bulging dry stone wall and the gradual loss of stone from the supporting buttress wall are of concern. The observed conditions suggest that

additional investigations are required to determine the extent of remedial measures necessary to insure the structural integrity of the dam.

Although considerable leakage emanates at the toe and through the face of the dry stone wall, there is no indication of undermining or that internal erosion is taking place in the upstream earth blanket.

There are no means to draw down the reservoir in emergencies.

There is no emergency warning or evacuation plan in effect for the facility.

The following investigation and remedial measures are recommended for immediate implementation by the owner:

(1) Perform additional hydrologic and hydraulic analysis to more accurately determine the required spillway capacity. As a result of the analysis, design and construct a spillway that will pass the required SDF without overtopping the dam.

(2) Perform additional investigations to evaluate the stability of the dam. Take corrective measures as indicated by these investigations.

(3) Remove trees from the dam proper, under the supervision of a Professional Engineer.

(4) Monitor the rate and clarity of water leakage through the dam. Take appropriate action as necessary.

(5) Observe the upstream slope for wave erosion damage and repair as necessary.

(6) Develop a method to draw down the reservoir in emergencies.

All investigations, monitoring programs and design of remedial measures should be performed by a Professional Engineer, experienced in the design and construction of dams.

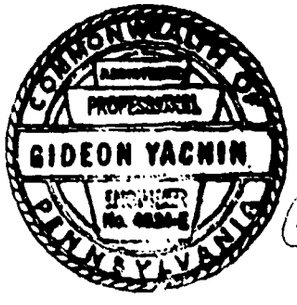
In addition, it is recommended that the owner take the following precautionary operational and maintenance measures:

(1) Develop a detailed emergency operation procedure and warning system to facilitate timely and orderly evacuation of the downstream population if any hazardous conditions at the dam are observed.

(2) When warnings of a storm of major proportions are given by the National Weather Service, activate the emergency operation and warning system procedures.

GLENBURN POND DAM

(3) After satisfactory implementation of the remedial measures resulting from the recommended additional investigations, institute a formal inspection and maintenance program for the dam. As presently required by the Bureau of Dams and Waterway Management of PENNDER, the program shall include an annual inspection of the dam by a Professional Engineer, experienced in the design and construction of dams. Deficiencies found during annual inspections should be remedied as necessary.



Submitted by:

GEO-TECHNICAL SERVICES, INC.

Gideon Yachin

GIDEON YACHIN, P.E.

Date: August 31, 1981

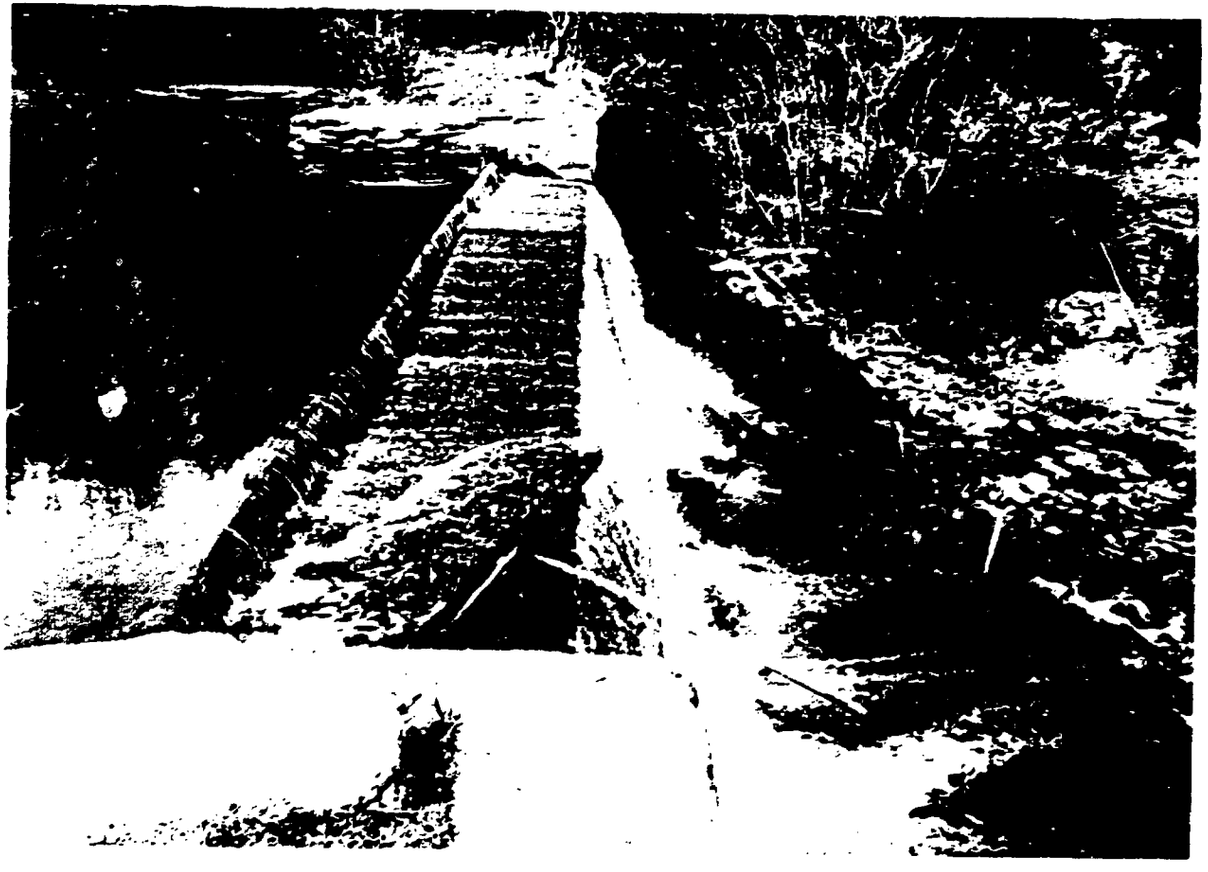
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 10 Sep 81



OVERVIEW OF GLENBURN POND DAM (PA 00371)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
GLENBURN POND DAM
NDI# PA-00371, PENNDER# 35-001

SECTION 1
GENERAL INFORMATION

1.1 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.2 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.3 Description of Project.

a. Dam and Appurtenances: Glenburn Pond Dam is a composite earthfill and dry stone masonry structure, terminating with an earthfill embankment on the left abutment. The 16.3-foot high dam has a total length of 190 feet, including the spillway and the earthfill embankment section. The spillway, located at the middle of the dam, consists of a broad crested concrete weir with an effective length of 51 feet. The upstream approach to the spillway has an earthfill bottom with stone and mortar side walls. There are no other constructed outlets through the dam.

b. Location: Glenburn Pond Dam is located on Dalton Run, a tributary to the South Branch Tunkhannock Creek, in Glenburn Township, Lackawanna County, one and one fourth miles south of Dalton, Pennsylvania. The dam and reservoir are contained within the Dalton, Pennsylvania 7.5 Minute Series USGS Quadrangle Map, at Latitude N41°31'07" and Longitude W75°43'42". A Location Map is shown in Exhibit E-1.

c. Size Classification: Small (16.3 feet high, 263 acre-feet storage capacity at top of dam).

d. Hazard Classification: High (see paragraph 3.1e).

e. Ownership: Natural Lands Trust, 1339 Chestnut Street, Philadelphia, Pennsylvania 19107 (Attention Lowell T. Young, Property Supervisor).

f. Purpose of Dam: Public recreation and conservation.

g. Design and Construction History: Information related to the design and construction of the dam is not available. Data obtained from the Pennsylvania Department of Environmental Resources (PENNDER) indicates that the dam was built prior to 1854. Although "as-built" drawings are not available, inspection reports, correspondence and photographs document repairs and maintenance activities since 1913. An inspection report dated May 5, 1913 describes the dam as a dry stone masonry dam having a vertical downstream face and an upstream batter of 3 on 4 faced with planking, against which was a gravel embankment. Two flumes (15'H x 20"W) with control gates on either side of the spillway were sealed off (see Photograph 4, Exhibit E-3), and timber braces were used to support the bulge and overhand of the right downstream wall (see Photograph 2, Exhibit E-2). Subsequent repair work using a dry stone buttress was undertaken in 1926 (see Photogtaphs 4 and 5, Exhibit E-3). Considerable leakage through the dam under the spillway was reported in 1956 and illustrated in the present inspection photograph 2, Exhibit C. Recent reconstruction of the plank spillway weir was reported orally by the owners representative, Mr. Lee Reese, during the present inspection (see spillway section, Exhibit A-4). Additional information is on file with the Pennsylvania Department of Environmental Resources (PENNDER) and the Pennsylvania Fish Commission.

h. Normal Operational Procedure: The pool is normally maintained at the spillway crest elevation with excess inflow discharging over the spillway into Dalton Run.

1.4 Pertinent Data.

a. Drainage Area: (square miles)	8.8
b. Discharge at Dam Site: (cfs)	
Maximum known flood at damsite since construction	Not Known
Outlet works at minimum pool elevation	Not Applicable
Spillway capacity at maximum pool elevation	
Design Conditions	Not Known
Existing Conditions	464
c. Elevation: (feet above msl) For datum see paragraph 3.1a.	
Top of Dam	
Design Conditions	Not Known
Existing Conditions (low point)	1036.3
Maximum Pool	
Design Conditions	Not Known
Existing Conditions	1136.3
Normal Pool (spillway crest)	1034.3
Upstream Invert Outlet Works	Not Applicable
Downstream Invert Outlet Works	Not Applicable
Streambed at Toe of Dam	1020.0

d. Reservoir Length: (feet)

Normal Pool	2100
Maximum Pool (at top of dam)	2170

e. Storage: (acre-feet)

Normal Pool	199
Maximum Pool	
Design Conditions	Not Known
Existing Conditions	263

f. Reservoir Surface: (acres)

Normal Pool	25.7
Maximum Pool	
Design Conditions	Not Known
Existing Conditions	39

g. Dam:

Type - Dry stone masonry and earth embankment.

Length (feet) (including spillway & earth embankment) 190

Height (feet) 16.3

Top Width (feet)

Design Conditions	Not Known
Existing Conditions	Varies from 10 to 21

Side Slopes - Upstream - Varies from 1V on 2.3H to 1V on 20H
Downstream - Near vertical wall with 45° stone buttess.

Zoning - See Type above.

Cut-off	Not Known
Impervious Core	Not Known
Grout Curtain	Not Known

h. Diversion and Regulating Tunnel: None

i. Spillway:

Type - Low Flow	Sharp crested rectangular plank weir.
- High Flow	Broad crested rectangular concrete weir.
Length of Weir (feet)	51
Crest Elevation (feet above MSL)	1034.3
Upstream Channel	Earth bottom

Downstream Channel - Vertical drop to dumped stone in streambed.

j. Outlet Works:

Type	Not Applicable
Length (feet) - estimated	Not Applicable
Closure and Regulating Facilities	Not Applicable
Access	Not Applicable

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available: There is no available information related to the design and construction of the dam. The earliest information available consists of photographs, correspondence and inspection reports beginning in May 1913 that are on file with PENNDER.

b. Design Features:

(1) Dam: The dam is a dry stone masonry gravity structure with a concrete capped near-vertical downstream wall. As a result of downstream bulges and overhangs, this wall is now supported by dry stone buttresses (see Exhibit A-3). The wall was reported to have an upstream slope of 3V on 4H that was covered with plank sheeting and gravel, and is now covered with an earthfill that varies in slope from 1V on 2.3H to 1V on 20H (see Exhibits A-3 and A-4). The dry stone wall is 16.3 feet high at its maximum section and 160 feet long, terminating with 30 feet of earthfill embankment on the left abutment (see Exhibit A-1). The total length of the dam is 190 feet, including a 51-foot spillway section near the center of the dam. The crest of the dam varies from 10 feet wide on the right abutment to 21 feet wide near the end of the left abutment. The top of the dam along its axis slopes down from both abutments to low points on the spillway wall (see Exhibit A-2).

(2) Appurtenant Structures:

(a) Spillway: The 51-foot long spillway acts as a sharp-crested weir under low flow conditions and as a broad-crested weir under high flow conditions. The sharp-crested weir is constructed with lapped 2 x 12" planks, 48" long, covered with sheet iron flashing, extending 12-inches above the downstream spillway slab. The broad-crested weir is a 5-foot wide concrete spillway slab that is 3.3 feet below the top of the spillway side walls. These walls curve at the upstream end to form an approach channel about 58 feet wide at a distance of about 15 feet upstream of the spillway drop (see Exhibit A-1). At the base of the vertical drop, large dumped stone boulders serve to dissipate energy and protect against undercutting of the vertical wall (see Exhibit A-4 and Photograph 3, Appendix C).

(b) Outlet Works: There are no provisions to draw down the reservoir. A May 5, 1913 dam inspection report states that two 15" x 20" sluiceways on either side of the spillway were abandoned and sealed. A September 2, 1937 dam inspection report states that "the upstream end of the outlet is covered with stones and silt and the valve is inaccessible".

2.2 Construction Records.

There are no records available for evaluation of construction methods and the classification or quality of materials placed in the dam.

2.3 Operation.

There are no records available to indicate the past operation procedures for the dam. In May 1978, PENNDER and the Pennsylvania Fish Commission approved a 1-foot draw down (siphon) of the lake for weed control purposes. The present normal operation of the facility is described in paragraph 1.3h, Section 1.

2.4 Other Investigations.

Information in PENNDER files indicates that several on-site inspections were made since May 5, 1913. The inspections revealed seepage flow from the downstream face of the masonry structure and bulging stone walls. The downstream bulging and overhang in the vertical stone wall has not had any significant movement since the inspection report of August 12, 1924.

2.5 Evaluation.

a. Availability of Data: Engineering data were extracted from the files of PENNDER and from information supplied by the Pennsylvania Fish Commission. The owner's representatives stated that, to the best of their knowledge, there are no plans or other information available on the design or construction of the dam.

b. Adequacy: In the absence of plans, engineering specifications and construction records, assessment of the dam and its safety must be based primarily on the visual inspection and the hydrologic and hydraulic analysis presented in Section 5.

c. Validity: There is no reason to question the validity of the available data.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General: The overall appearance of the dam is poor. Deficiencies observed during the field inspection are illustrated on the General Plan, Exhibit A-1, Appendix A. The profile and typical sections of the dam are presented in Exhibits A-2, A-3 and A-4, and are based on field survey made the day of the inspection. The survey datum for this inspection is based on interpolation of USGS contour lines shown on Exhibit A-1. On the inspection date (May 14, 1981), the lake level was at elevation 1034.5, about 0.2-foot above the spillway crest. Pertinent features observed are shown in Photographs, presented in Appendix C.

b. Dam: Observations made during the field inspection reveal that the earth and dry stone masonry dam is in poor condition. The dam is reported to be more than 127 years old. The top surface of the dam slopes down from both abutments to the spillway walls, as illustrated on Exhibit A-2. The downstream vertical dry stone wall bulges downstream and overhangs 14 inches on the right half and 11 inches on the left half (see Exhibit A-3, and Photograph 7, Appendix C). The top of the wall is covered with a concrete cap (2' wide and 9" thick) along its entire length. The concrete cap has a 1½ inch wide vertical crack about 22 feet right of the spillway near the maximum bulge point (see Exhibit E-1). The downstream wall is supported by stone buttresses, as shown in Exhibits A-1, A-3 and photograph 3, Appendix C. Part of the left buttress is wedged between the vertical stone wall and the 10-inch wide concrete foundation wall of an abandoned ice house (see Exhibits A-1 and A-4). The buttress and stone wall are constructed with "one and two man" sandstone boulder slabs. The top 25 to 50 percent of the buttress stones near the spillway have been displaced (probably dumped in the spillway splash area). The spillway splash apron consists of a 3-foot high pile of large boulders, dumped against the vertical wall under the entire spillway length. Scattered leakage points, spurting about 1 GPM, are visible in the stone wall below the spillway (see Photograph 2, Appendix C). A point source leak of about 100 GPM is located at the left toe of the right buttress, about 22 feet downstream of the dam (see Photograph 4, Appendix C). There is no accumulation of fines in the leakage area. Brush and trees to 10 inches in diameter are growing in the stone wall and on the earth embankment slopes.

c. Appurtenant Structures:

(1) Spillway: The overall appearance of the spillway is fair. The spillway consists of a combination low flow sharp-crested plank weir and a high flow broad-crested concrete weir, both 51 feet in length. Below the spillway is a dumped rock splash apron. Details of the spillway and splash apron are described in Section 2.1b, 2(a), and illustrated in Exhibit A-1, A-2 and A-4. Observed features are described in the "Visual Inspection

Check List" in Appendix A and shown in the Photographs in Appendix C. Flow over the spillway on the inspection date was 0.17-foot above the weir crest. The owners representative stated that the present plank weir was constructed in the summer of 1980 and that cracks in the spillway walls and wall cap were repaired at that time.

(2) Outlet Works: There are no existing facilities to draw down the reservoir level. PENNDER files indicate that in May 1978, approval was given for a 1-foot draw down of the lake by use of a siphon.

d. Reservoir Area: The right side of the reservoir is bordered by a four lane highway and residential area with slopes under 5 percent. The upstream area south and southwest of the reservoir area has wooded slopes of 10 to 15 percent. The left shore of the reservoir contains wooded slopes of 15 to 25 percent. There is no evidence of unstable slope conditions that would affect the safety of the dam. The large marshy sedimentation area at the southeast end of the lake is reported to have accumulated during the past 15 years. This sedimentation problem has resulted in reducing the surface area of the lake and the shallow (3 to 6' deep) marshy conditions. Pertinent watershed features are shown in Exhibit E-1. Geologic conditions in the area are described in Appendix F.

e. Downstream Channel: Downstream of the dam, the stream channel has a gradient of about 1.25 percent for 1500 feet and then flattens to less than 1 percent. Along the first 150 feet, both sides of the channel are wooded with steep side slopes (1V on 1½H). The balance of the stream channel has gentle side slopes containing scattered trees, open lawn areas and several homes within 200 feet of the stream banks. In the town of Dalton, about 1¼ miles downstream, much of the stream channel is confined between constructed vertical walls in a flood plain that is about 600 feet wide. The downstream survey indicates that within 1¼ mile downstream of the dam, about 20 homes and businesses, a fire station and a public school would be seriously damaged and more than a few lives may be lost should Glenburn Pond Dam fail. Consequently, Glenburn Pond Dam is classified as a high hazard structure.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Normal Operating Procedures.

The reservoir is maintained at normal pool with excess inflow discharging over the spillway. During low inflow periods, much of the flow would leak through the dam and pool levels would drop below spillway crest elevation.

4.2 Maintenance of Dam.

Maintenance of the dam by the present owners is minimal and limited to specific repair projects. The absence of trash and debris indicates that cleanup activities are maintained. There was no evidence of efforts to replace the displaced buttress stones, or to remove the brush and trees growing on the upstream slope and downstream wall.

4.3 Maintenance of Operating Facilities.

There are no operating facilities at the dam.

4.4 Warning System in Effect.

There is no emergency operating and warning system in effect.

4.5 Evaluation.

The maintenance of the dam is inadequate. The missing buttress stones should be replaced, the trees and brush should be removed from the dam and the owner should institute regularly schedules maintenance inspections. The leakage flows should be monitored to detect any changes in quantity and turbidity. Findings and subsequent maintenance and repair work should be documented. A surveillance program should be developed to detect any adverse conditions at the dam and a method of emergency drawdown should be instituted. An emergency warning system and a formal evacuation plan should be prepared to evacuate the downstream population if adverse conditions develop at the dam.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Design Data.

There are no hydrologic and hydraulic data available for Glenburn Pond Dam.

5.2 Experience Data.

The probable flood of record in Dalton Run, a tributary to the South Branch Tunkhannock Creek, is the March 1964 flood. Other major floods within the Susquehanna River Basin in this century are those of May 1942, August 1955, June 1972 and September 1975. Flood stages or flow records at the damsite or above the mouth of Dalton Run are not available. There is no information available relative to overtopping occurrences of the dam during the aforementioned floods.

5.3 Visual Observations.

Based on the visual inspection and field survey, described in Section 3 of this report, the observations relevant to hydrology and hydraulics are evaluated below.

a. Dam: The present low point on top of the dam is at elevation 1036.3, or 2 feet above the spillway crest. The variation in dam crest elevation shown in Exhibit A-2, Appendix A, is based on a field survey conducted during the May 14, 1981 inspection.

b. Spillway: The cross section of the 51 foot long weir is presented in Exhibit A-4, Appendix A. The weir configuration appears to function as a sharp-crested weir, when subjected to relatively low head, and as a broad-crested weir during flood flow discharges. The shape of the weir resembles a model weir that was tested at the hydraulic laboratory of Cornell University and for which discharge coefficients were established (see Sheet D-8, Appendix D).

c. Reservoir Area: There are two major inlets into the reservoir, as shown in Exhibit E-1, Appendix E. Of the total 8.8 square-mile drainage area of the reservoir, 25% contributes to the inflow at the southern inlet and the remaining 75% to the inflow at the eastern inlet, located some 1000 feet southeast of the right abutment. There are no upstream structures of significant influence on the rate and time of flood inflow into Glenburn Pond. Because of the size of the drainage area, future minor changes in the prevailing land use within the watershed would not significantly alter the hydrologic and hydraulic analysis, summarized in paragraph 5.5.

d. Downstream Conditions: The spillway capacity, as well as the overtopping discharge capacity over the dam, are not affected by tailwater conditions for the entire range of discharges considered in this study.

5.4 Method of Analysis.

Hydrologic and hydraulic evaluation was made in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, Phase I Safety Inspection of Dams. The analysis ha been performed utilizing the HEC-1DB program developed by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. brief description of program capabilities, as well as the input and output data used specifically for this analysis, is presented in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood: According to criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (small) and hazard potential (high) of the Glenburn Pond Dam is between the one-half Probable Maximum Flood (1/2 PMF) and the full PMF. Because of the small storage capacity in the reservoir, the 1/2 PMF is selected as the SDF for the Glenburn Pond Dam.

b. Results of Analysis: Pertinent results are tabulated in Appendix D. The present spillway capacity of 464 cfs (cubic feet per second) can pass approximately 2% of the PMF. The computed reservoir inflow for 50% of the PMF is 9630 cfs and that for 10% of the PMF is 1930 cfs. An overtopping depth of 1.9 feet and overtopping duration of 8.5 hours were derived for the discharge resulting from the 10% of the PMF. It was judged that the dam cannot withstand an overtopping depth of more than one foot without failure. Dam breach analyses were performed assuming the Dam would fail at overtopping depth of 1 foot and that the resulting breach in the dam would be 30 to 50 feet wide. The dam was assumed to be breached for its entire height, as well as to an elevation 6 feet above the streambed, which represents the top of the road downstream of the dam (see Sheet D-11, Appendix D). Flows corresponding to 0.1 PMF and 0.5 PMF, the SDF, were used for the analyses.

The results indicate that the maximum outflow at failure for the 0.1 PMF is approximately 12,500 cfs. When this flow is routed downstream to the first group of dwellings, the flood stage is increased by approximately 3.9 feet over the water surface that would have occurred had the dam not failed. For the lower reach studied, an increased flood stage of 3.2 feet was calculated. This rise in flood stages would increase the downstream hazard to loss of life and property damage.

c. Spillway Adequacy: Because the spillway capacity will not pass the SDF without overtopping the dam and because the dam may fail during flood magnitudes that are considerably lower than 1/2 PMF and thereby increase the hazard to life and property downstream, the spillway is rated as seriously inadequate.

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations.

The visual inspection of Glenburn Pond Dam is described in Section 3. Observations that are relevant to structural stability of the dam and the appurtenant structures are evaluated below.

a. Dam: The bulging vertical dry stone wall, the overhung stones on top of the wall and the loss of 25 to 50 percent of the stone buttress, left of the spillway, indicate that the support added to the dam in 1926 is weakening. A 1-1/2 inch wide vertical crack in the stone wall concrete cap is located 22 feet to the right of the spillway. Although the aforementioned observed deficiencies are of concern, they were in existence since 1926. The observed conditions are insufficient for quantitative analysis of the dam stability. These conditions indicate that additional investigations are required to determine the remedial measures necessary for the structural integrity of the dam.

b. Spillway: Repairs made in the summer of 1980 (see paragraph 3.1 c(1) included the construction of the present plank weir. The spillway appears to be structurally sound.

6.2 Design and Construction Data.

Available design and construction data are inadequate to assess the present stability of the dam; thus, the evaluation is based on visual inspection.

6.3 Past Performance.

Construction of a temporary support (timber bracing) of the bulging right dry stone wall was necessitated prior to 1914. This temporary support was replaced by a dry stone buttress in 1926. Considerable leakage through the dam under the spillway weir was reported in 1956 and persists at the present time.

6.4 Seismic Stability.

The dam is located in Seismic Zone 1 and may be subject to minor dynamic forces induced by earthquakes. Generally, if the dam is stable under static load conditions, it can be assumed safe under minor earthquake load conditions in this zone. However, since the static stability of the structure is questionable, its seismic stability cannot be assessed.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety:

(1) Based on available records, past performance, visual inspection, field survey and calculations, the Glenburn Pond Dam is judged to be in poor condition. Based on the small size and the high hazard classification of the dam, the recommended Spillway Design Flood (SDF) varies between the one-half of the Probable Maximum Flood (1/2 PMF) and the full PMF. Because of the small storage capacity in the reservoir, the 1/2 PMF is selected as the SDF for Glenburn Pond Dam. The present spillway capacity of 464 cfs (cubic feet per second) can pass approximately 2% of the PMF. Overtopping analysis indicates overtopping depths of 1.9 feet and 5 feet during flood magnitudes of 0.1 PMF and 0.5 PMF, respectively. The duration of overtopping for the aforementioned floods is 8.5 and 11.75 hours, respectively. Failure of the dam would increase the downstream hazard to loss of life and property.

Based on the above assessment, the spillway is classified as seriously inadequate and the facility is rated unsafe, non-emergency.

The bulging dry stone wall and the gradual loss of stone from the supporting buttress wall are of concern. The observed conditions suggest that additional investigations are required to determine the extent of remedial measures necessary to insure the structural integrity of the dam.

(2) Although considerable leakage emanates at the toe and through the face of the dry stone wall, there is no indication of undermining or that internal erosion is taking place in the upstream earth blanket.

(3) There are no means to draw down the reservoir in emergencies.

(4) There is no formal inspection and maintenance program for the dam.

(5) There is no emergency warning or evacuation plan in effect for the facility.

b. Adequacy of Information: The data collected from previously cited dam inspection reports, past performance, visual inspection and computations performed as part of this study are sufficient for Phase I Dam Safety Assessment.

c. Urgency: The recommendations presented in Section 7.2 should be implemented immediately.

d. Necessity for Further Investigations: In order to accomplish some of the remedial measures outlined in paragraph 7.2, further investigation by a Professional Engineer, experienced in the design and construction of dams, will be necessary.

7.2 Recommendations and Remedial Measures.

a. The following investigations and remedial measures are recommended for immediate implementation by the owner.

(1) Perform additional hydrologic and hydraulic analysis to more accurately determine the required spillway capacity. As a result of the analysis, design and construct a spillway that will pass the required SDF without overtopping the dam.

(2) Perform additional investigations to evaluate the stability of the dam. Take corrective measures as indicated by these investigations.

(3) Remove trees from the dam proper, under the supervision of a professional engineer.

(4) Monitor the rate and clarity of water leakage through the dam. Take appropriate action as necessary.

(5) Observe the upstream slope for wave erosion damage and repair as necessary.

(6) Develop a method to draw down the reservoir in emergencies.

All investigations, monitoring programs and design of recommended measures should be performed by a professional engineer, experienced in the design and construction of dams.

b. In addition, it is recommended that the owner take the following precautionary operational and maintenance measures:

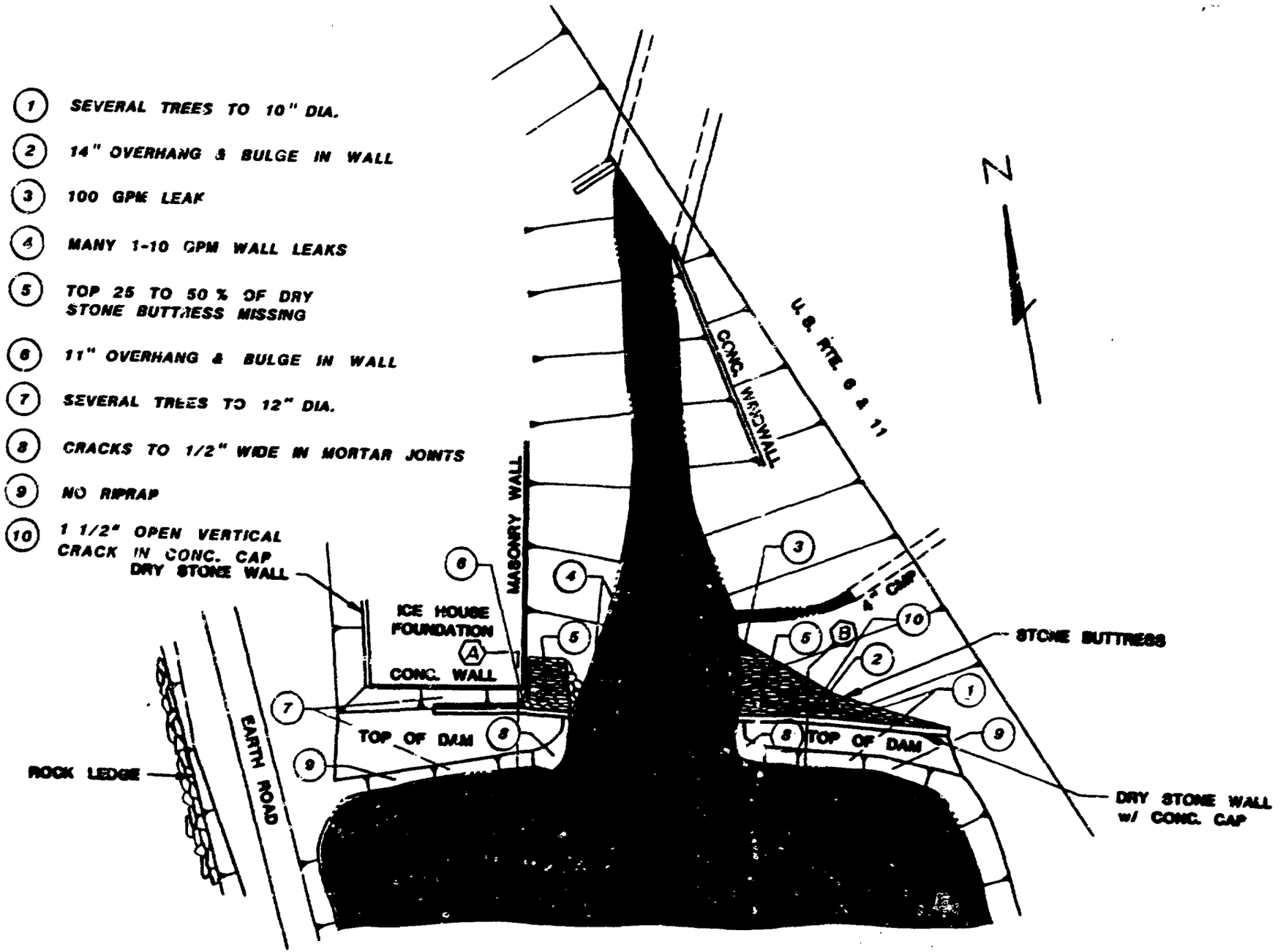
(1) Develop a detailed emergency operation procedure and warning system to facilitate timely and orderly evacuation of the downstream population if any hazardous conditions at the dam are observed.

(2) When warnings of a storm of major proportions are given by the National Weather Service, activate the emergency operation and warning system procedures.

(3) After satisfactory implementation of the remedial measures resulting from the recommended additional investigations, institute a formal inspection and maintenance program for the dam. As presently required by the Bureau of Dams and Waterway Management of PENNDER, the program shall include an annual inspection of the dam by a Professional Engineer, experienced in the design and construction of dams. Deficiencies found during annual inspections should be remedied as necessary.

APPENDIX A

VISUAL INSPECTION - CHECKLIST AND FIELD SKETCHES



GLENBURN POND DAM
GENERAL PLAN - FIELD INSPECTION NOTES

EXHIBIT A-1

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB [illegible]
SHEET NO 1 OF 1
CALCULATED BY RJM DATE 6-2-81
CHECKED BY _____ DATE _____
SCALE HORZ 1" = 50' VERT. 1" = 4'

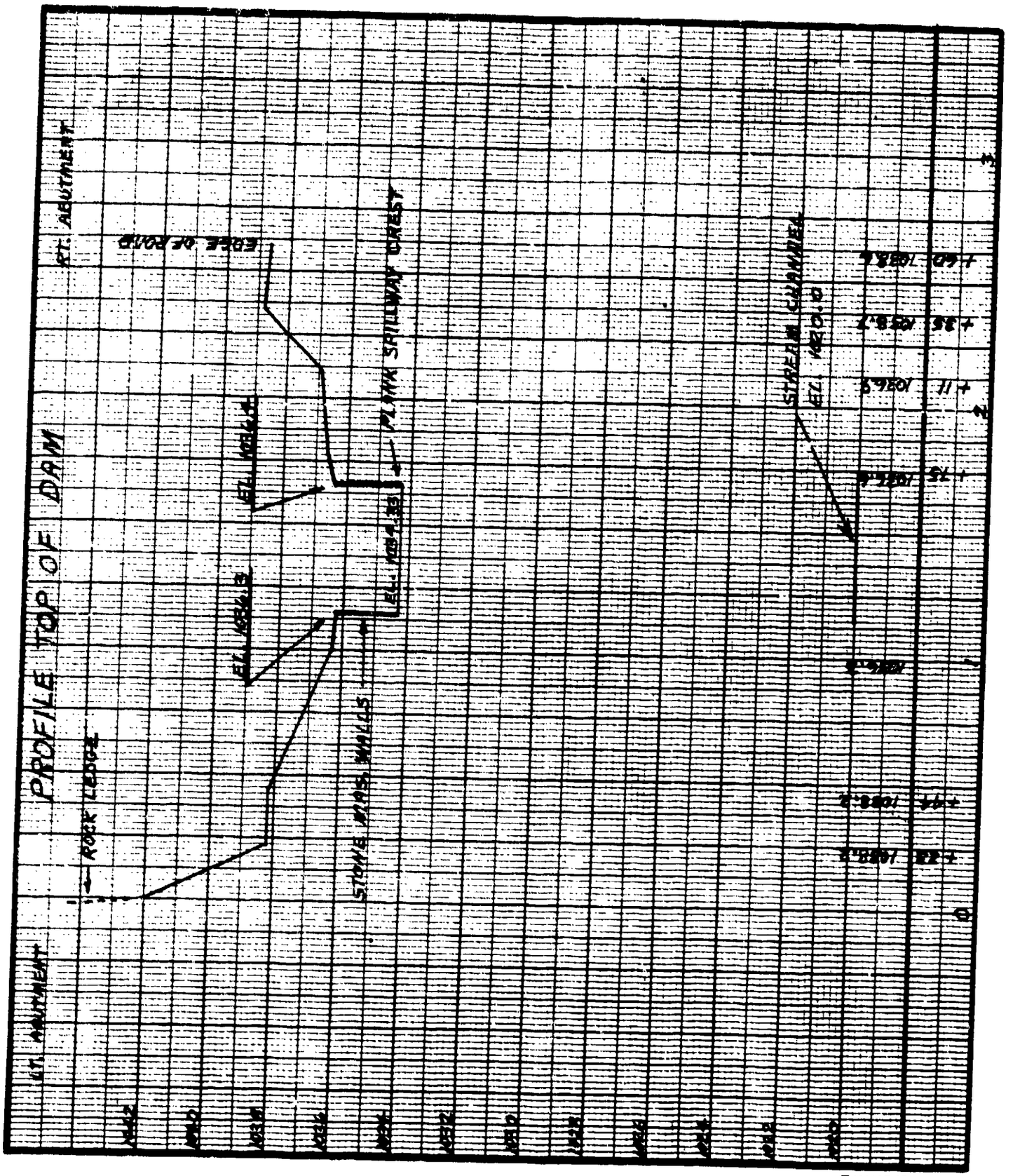
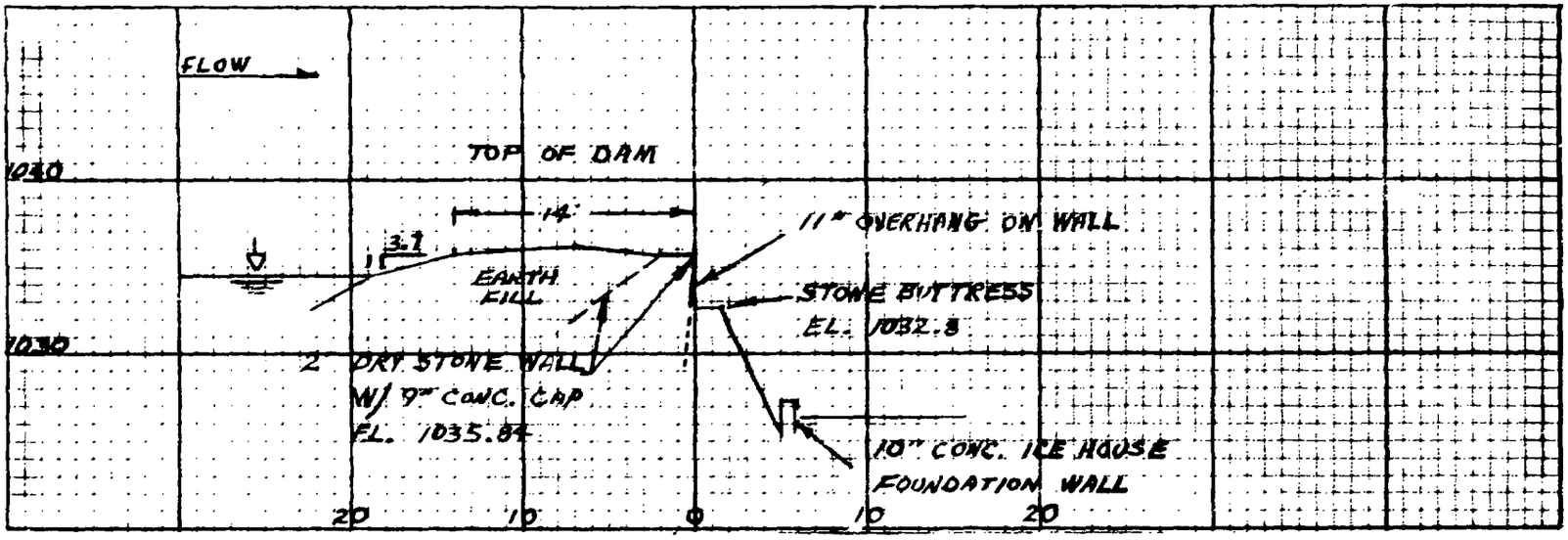
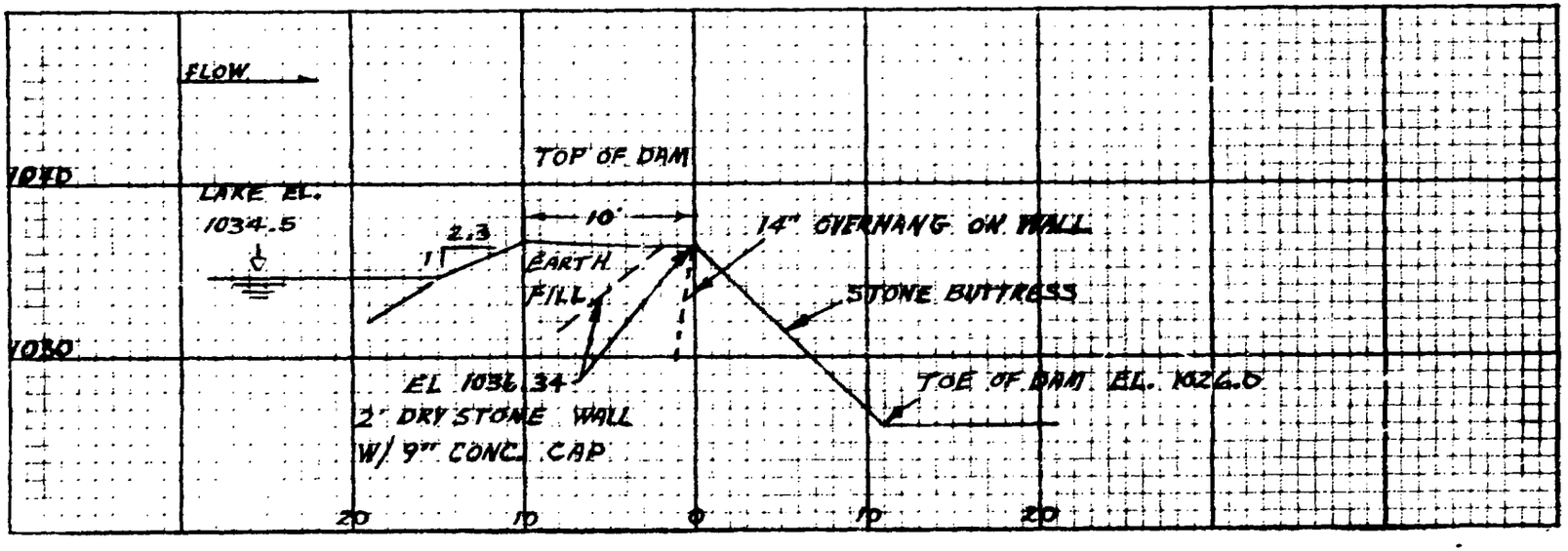


EXHIBIT A-2

TYPICAL DAM SECTIONS



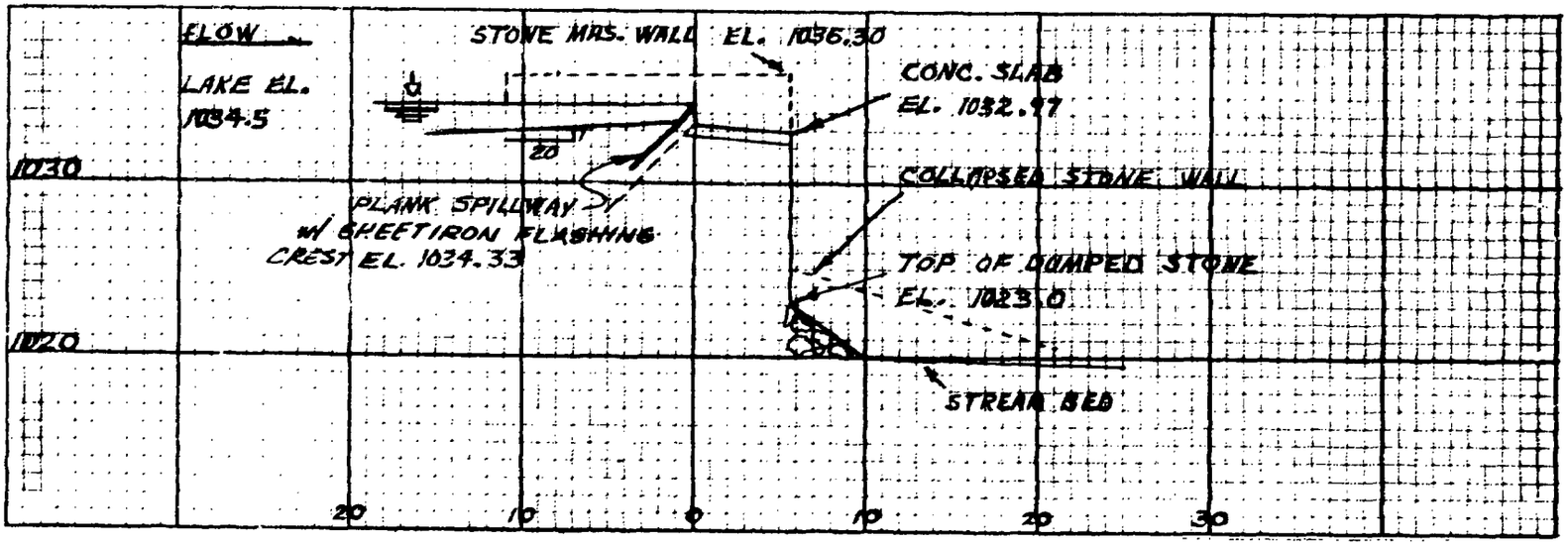
SECTION A



SECTION B

EXHIBIT A-3

TYPICAL DAM SECTION



SPILLWAY SECTION

EXHIBIT A-4

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Glenburn Pond Dam STATE Pennsylvania COUNTY Lackawanna

NDI # PA — 00371 PENNDER # 35-1

TYPE OF DAM Dry stone wall & earth embankment SIZE Small HAZARD CATEGORY High

DATE(S) INSPECTION May 14, 1981 WEATHER Partly Cloudy TEMPERATURE 24°C @ 2:00 p.m.

POOL ELEVATION AT TIME OF INSPECTION 1034.5 M.S.L.

TAILWATER AT TIME OF INSPECTION 1020.0 M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	*OTHERS*
Vaden Butler, Engineer	Lee Rees	
James Diaz, Geologist	Lowell Young	
Ronald Mather, Surveyor	Ken Rees	

RECORDED BY V. Butler

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA 00371
SURFACE CRACKS	Concrete cap on right downstream wall has 1½" open vertical crack about 22' right of the spillway.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	A downstream bulge and overhang on downstream wall is 11" H in 4.5'V on the left wall and 14" H in 4.5'V on the right wall. The right half of the wall is buttressed by rock laid 1 on 1 except for an area 12' right of spillway and 6' below dam crest. The left half of dam is partly butressed between ice house wall and dam wall.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Crest not level. Grades down to spillway. Downstream wall has downstream bulges on both sides.
RIPRAP FAILURES	No riprap.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Both abutments are dry and show no evidence of erosion.

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA-00371
DAMP AREAS (IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None
ANY NOTICEABLE SEEPAGE	Many small leaks (1 GPM+) discharging from face of wall below entire length of spillway (total flow indefinite). A point source leak of about 100 GPM discharge from the left toe of the right buttress about 22' downstream of the dam. There is no accumulation of fines at this discharge point.
STAFF GAGE AND RECORDER	None
DRAINS	None
ROCK OUTCROPS	A 10 to 15 foot exposed bedrock face of red and gray shale and fine sandstone (strike W-45°E, Dip 12°NW) is exposed on the left abutment at the dam site.
TREES	Brush and trees to 10" diameter are growing in the stone wall and embankment on both sides of the dam.

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA-00371
INTAKE STRUCTURE	None
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	None visible.
OUTLET STRUCTURE	None
OUTLET CHANNEL	None
GATE(S) AND OPERATIONAL EQUIPMENT	None.

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA-00371
TYPE AND CONDITION	None
APPROACH CHANNEL	None
SPILLWAY CHANNEL AND SIDEWALLS	None
STILLING BASIN PLUNGE POOL	None
DISCHARGE CHANNEL	None
BRIDGE AND PIERS EMERGENCY GATES	None

SERVICE SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00371
TYPE AND CONDITION	See Exhibit A-1. Sharp edge weir for low flows (lapped 2" x 12" x 48" long planks with Sheetiron flashing on top and inserted 36" into ground at 45° angle with 12" exposed for a length of 51 feet). A 5-foot wide, 51-foot long concrete spillway slab serves as broad crested weir for high flows.
APPROACH CHANNEL	The spillway approach is 0.7' below weir crest and has a gentle upstream slope for a distance of 12'.
OUTLET STRUCTURE	None
DISCHARGE CHANNEL	Natural stream channel.

INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00371
MONUMENTATION SURVEYS	None
OBSERVATION WELLS	None
WEIRS	None
PIEZOMETERS	None
OTHERS	None

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00371
SLOPES: RESERVOIR	20% wooded slope on left abutment of lake area. 100' wide four lane highway on right abutment at dam with 15 to 20 percent wooded slopes on right abutment of lake area. There are no slope conditions that could affect the safety of the dam.
SEDIMENTATION	Severe. Mr. Rees reports that the large (2 to 3 acres) marsh deposits at the southeast end of the lake have accummulated during the past 15 years. Lake depth is reported to vary from 3 to 6 feet deep.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Highway bridge 150' downstream of dam. (16.8' high by 22.0' wide opening).
SLOPES: CHANNEL VALLEY	The stream drops 20' in 1500' has natural wooded slopes and lawn areas on both sides. In the vicinity of Dalton (about 1 mile downstream) the channel slopes are steep excavated slopes and constructed vertical walls.
APPROXIMATE NUMBER OF HOMES AND POPULATION	About 20 homes and businesses, a fire station and a public school are located adjacent to the stream and in the flood plain.

APPENDIX B

ENGINEERING DATA - CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM Glenburn Pond Dam

ITEM	REMARKS	NDI# PA - 00371
PERSONS INTERVIEWED AND TITLE	Lee Rees, Lowell Young and Ken Rees, Owner's representatives	
REGIONAL VICINITY MAP	See Exhibit E-1, Appendix E	
CONSTRUCTION HISTORY	The dam was constructed prior to 1854. There is no information available on the design and construction of the dam.	
AVAILABLE DRAWINGS	None available	
TYPICAL DAM SECTIONS	See Exhibit A-3, Appendix A	
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	No outlet works	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA- 00371
SPILLWAY: PLAN SECTION DETAILS	See Exhibit A-4, Appendix A	
OPERATING EQUIP- MENT PLANS AND DETAILS	No operating equipment	
DESIGN REPORTS	None available	
GEOLOGY REPORTS	None available. For description of site geology, see Appendix F.	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	None available	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 00371
BORROW SOURCES	Not known	
POST CONSTRUCTION DAM SURVEYS	None prior to 5/14/1981	
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Inspection reports since 1913, on file with PennDER.	
HIGH POOL RECORDS	None available	
MONITORING SYSTEMS	None	
MODIFICATIONS	Two flumes (15" H x 20" W) with control gates on either side of the spillway were sealed off, circa 1926.	

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA - 00371
PRIOR ACCIDENTS OR FAILURES	None reported. Bulging and overhang of the right downstream wall required bracing and subsequent repairs.
MAINTENANCE: RECORDS MANUAL	None available
OPERATION: RECORDS MANUAL	None available
OPERATIONAL PROCEDURES	Self-regulating.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	None in effect at the present time.
MISCELLANEOUS	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-00371
PENNDER ID #35-001

SIZE OF DRAINAGE AREA: 8.8 square miles

ELEVATION TOP NORMAL POOL: 1034.3 STORAGE CAPACITY: 199 acre feet

ELEVATION TOP FLOOD CONTROL POOL: NA STORAGE CAPACITY: NA

ELEVATION MAXIMUM DESIGN POOL: Unknown STORAGE CAPACITY: Unknown

ELEVATION TOP DAM: 1036.3 STORAGE CAPACITY: 263 acre feet

SPILLWAY DATA

CREST ELEVATION: 1034.3

TYPE: Broad crested weir

CREST LENGTH: 51 feet

CHANNEL LENGTH: 15-foot approach channel

SPILLOVER LOCATION: Middle of the dam

NUMBER AND TYPE OF GATES: None

OUTLET WORKS NO OUTLET WORKS

TYPE:

LOCATION:

ENTRANCE INVERTS:

EXIT INVERTS:

EMERGENCY DRAWDOWN FACILITIES:

HYDROMETEOROLOGICAL GAGES

TYPE: None

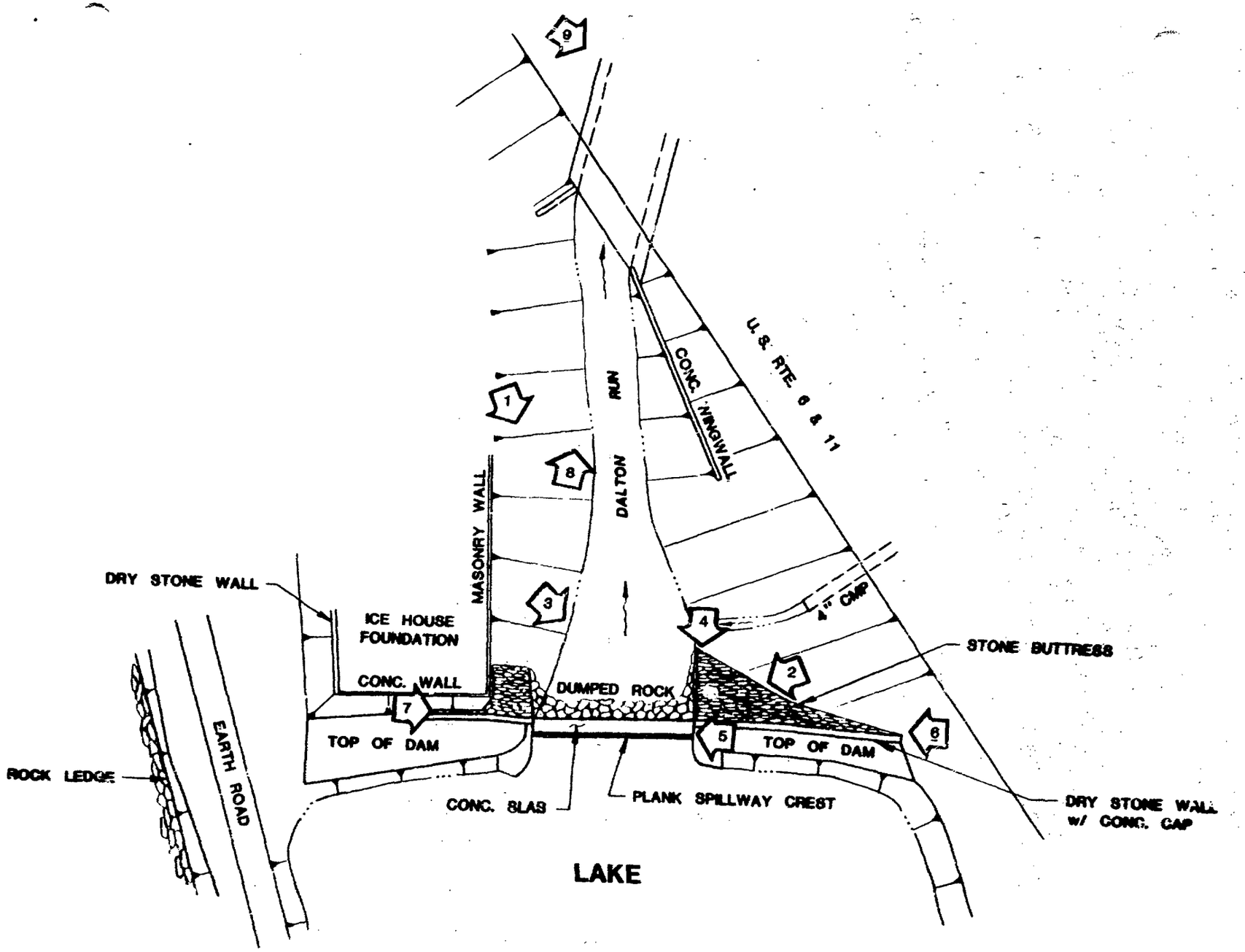
LOCATION: NA

RECORDS: NA

MAXIMUM NON-DAMAGING DISCHARGE: 464 cfs

APPENDIX C

PHOTOGRAPHS



GLENBURN POND DAM
PHOTOGRAPHS LOCATION MAP

NO. 10 PHOTO LOCATION
1000' UPSTREAM

EXHIBIT C-1

1. GENERAL VIEW OF DAM, FACING UPSTREAM

2. VIEW FACING LEFT ABUTMENT AND SHOWING LEAKS (ARROWS) THRU DAM AND LEFT STONE BUTTRESS

3. VIEW FACING RIGHT ABUTMENT SHOWING RIGHT STONE BUTTRESS AND DUMPED ROCK APRON

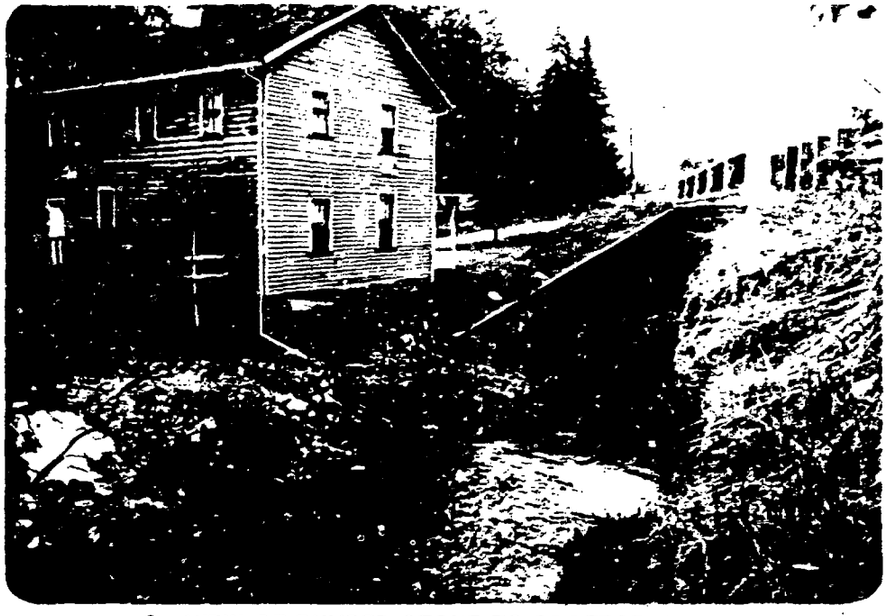
4. VIEW OF 100 GPM LEAK AT DOWNSTREAM TOE OF RIGHT BUTRESS

5. VIEW SHOWING DOWNSTREAM BULGE OF LEFT STONE WALL OPPOSITE MAN

6. VIEW SHOWING DOWNSTREAM BULGE OF RIGHT STONE WALL IN FOREGROUND

7. VIEW SHOWING 11' OVERHANG OF LEFT WALL

8. VIEW OF HIGHWAY BRIDGE DOWNSTREAM OF DAM



9. VIEW OF DUMPED STONE TO PROTECT HOME DOWNSTREAM OF HIGHWAY BRIDGE

10. VIEW OF SEDIMENT BUILDUP (ARROWS) FROM SOUTHEAST TRIBUTARY

APPENDIX D

HYDROLOGY AND HYDRAULICS

SUMMARY DESCRIPTION OF FLOOD HYDROGRAPH PACKAGE (HEC-1) DAM SAFETY INVESTIGATIONS

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the over-topping potential of the dam, and (2) estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam over-topping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would over-top the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge, time of the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program, refer to the Users Manual for the Flood Hydrograph Package (HEC-1), Dam Safety Investigations prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

SHEET NO _____ OF _____
CALCULATED BY WEH DATE _____
CHECKED BY _____ DATE _____
SCALE _____

1.) GENERATE HYDROGRAPHS FOR GLENBURN POND (SUB-AREA 1 & 2)

2.) COMBINE HYDROGRAPHS

3.) ROUTE THRU GLENBURN POND

4.) ROUTE THRU DOWNSTREAM SECTIONS

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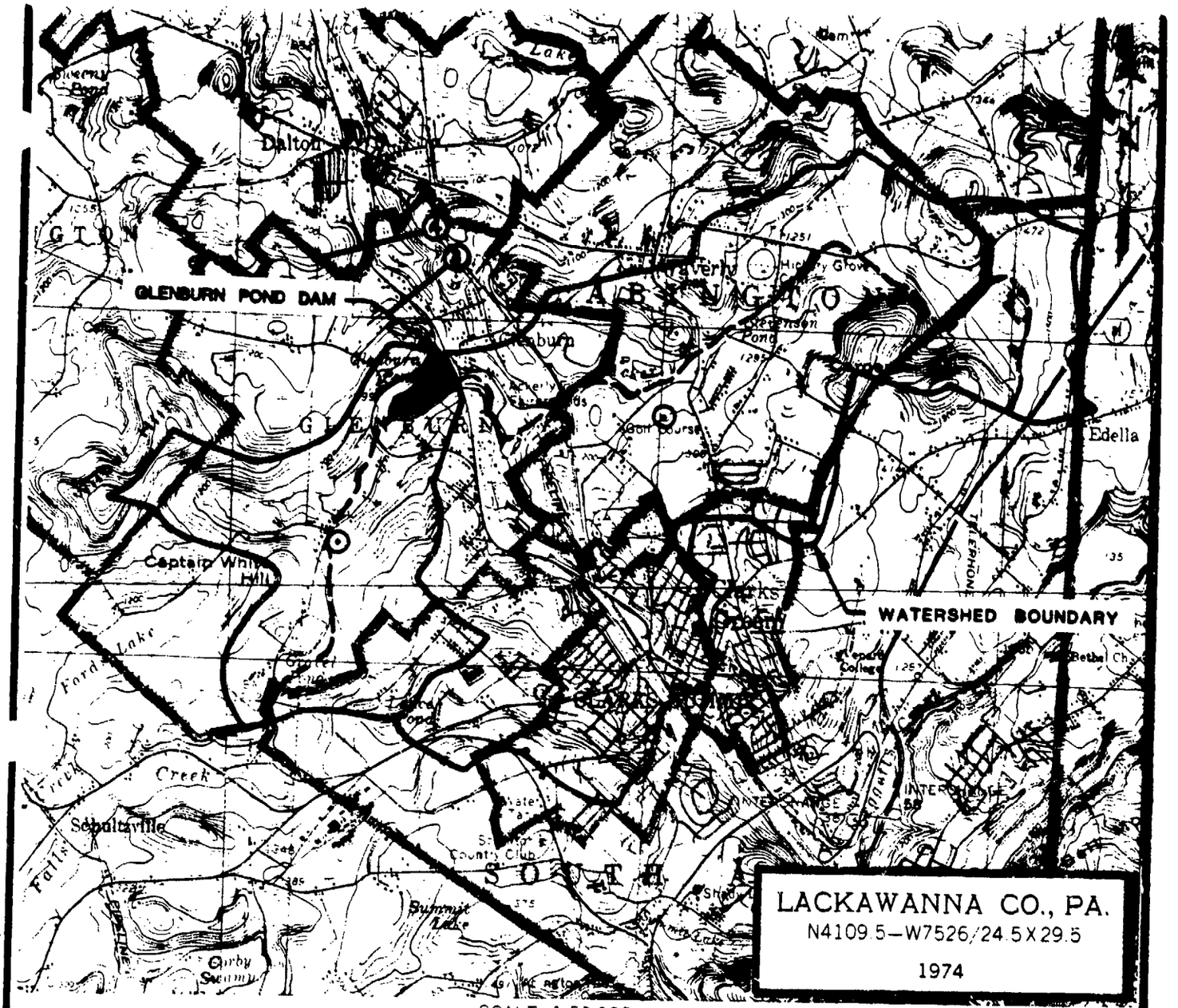

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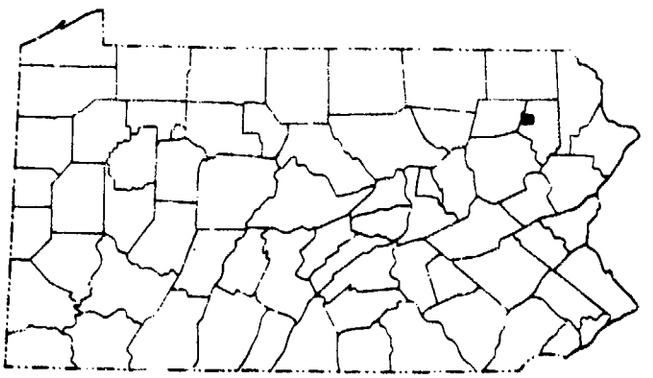

COUNTY LOCATION

LONGEST WATERCOURSE

CENTROID OF DRAINAGE AREA

EXHIBIT E-1

REGIONAL VICINITY AND WATERSHED BOUNDARY MAP

JOB GLENBURN POND DAM PA-0371

SHEET NO _____ OF _____

CALCULATED BY MEH DATE _____

CHECKED BY _____ DATE _____

SCALE _____

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

GENERAL DATA

RIVER BASIN	SUSQUEHANNA
STREAM NAME	DALTON RUN
DAM NAME	GLENBURN POND DAM
NDI ID No	PA-0371
DER ID No	35-001
OWNER	NATURAL LANDS TRUST INC.
LOCATION	GLENBURN BORO., LACKAWANNA Co., PA
	LAT. 41°31'06"
	LONG. 75°43'02"
SIZE CATEGORY	SMALL
HAZARD CATEGORY	HIGH
UPSTREAM DAMS	NONE
DOWNSTREAM DAMS	NONE

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GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB GLENBURN POND DAM PA-0371
SHEET NO. ____ OF ____
CALCULATED BY MEH DATE ____
CHECKED BY ____ DATE ____
SCALE ____

GLENBURN POND DAM

DRAINAGE BASIN & UNIT HYDROGRAPH DATA

DRAINAGE AREA — 2.2 Sq. Mi. (SUB-AREA 1)
6.6 Sq. Mi. (SUB-AREA 2)

SNYDER UNIT HYDROGRAPH COEFFICIENTS
AS SUPPLIED BY BALT. DIST. COE (SUSQUEHANNA BASIN ZONE II)

$C_P = 0.62$
$C_t = 1.50$

LAG TIME = $T_p = C_t (L \times L_{ca})^{0.3}$

SUB-AREA 1	SUB-AREA 2	
$L = 2.42$ mi.	$L = 5.02$ mi.	DAM TO DRAINAGE DIVIDE
$L_{ca} = 1.23$ mi.	$L_{ca} = 1.67$ mi	DAM TO CENTROID
$T_p = 2.08$ HRS	$T_p = 2.84$ HRS	LAG TIME

RAINFALL DATA

PER HYDROMETEOROLOGICAL REPORT No. 40
PMF RAINFALL = 22.2" (24 HR & 200 Sq. Mi.)
GEOGRAPHIC ADJUSTMENT FACTOR = 0.96
∴ PMP = 22.2 × 0.96 = 21.3"

FORM 204 Available from NEBS Inc. Townsend, Mass 01474

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB GLENBURN POND DAM PA-0371
SHEET NO _____ OF _____
CALCULATED BY MEH DATE _____
CHECKED BY _____ DATE _____
SCALE _____

RAINFALL DISTRIBUTION

6 HR	118%
12 HR	127%
24 HR	136%
48 HR	142%

DAM DATA

TOP OF DAM ELEV. (LOW POINT)	1036.3
DAM LENGTH (INC. SPILLWAY)	190'
DAM HEIGHT	16.3'
DAM WIDTH	VARIES

NON-LEVEL DAM

LENGTH OF DAM	BELOW ELEV.
0'	1036.3
35'	1036.6
75'	1036.9
132'	1038.2
156'	1038.3
160'	1038.6
323'	1038.8
370'	1040.0

FORM 204 Available from NEES Inc. Tamworth Mass 01876

JOB GLENBURN POND DAM PA-0371

SHEET NO. 1 OF

CALCULATED BY MEH DATE

CHECKED BY DATE

SCALE

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

SPILLWAY DATA

COMPUTE SPILLWAY RATING CURVE & INPUT DIRECTLY (SEE SW. O-8)

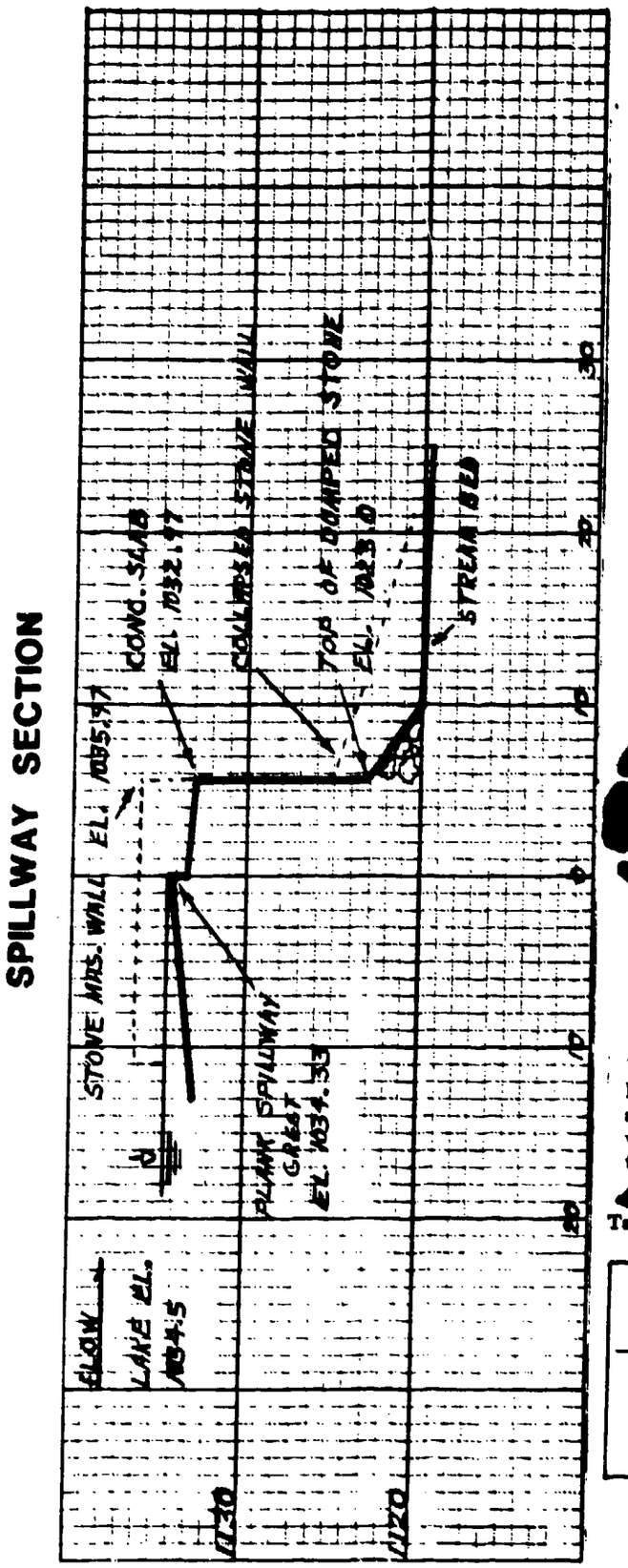
$Q = CLH^{3/2}$

$C = 3.22$

$L = 51'$

W.S. ELEV	H	Q
1034.3	0	0
1034.5	.2	15
1035.0	.7	96
1035.5	1.2	216
1036.3	2.0	464
1037.0	2.7	729
1038.0	3.7	1169
1039.0	4.7	1673
1040.0	5.7	2235

FORM 204 Available from NEBS Inc. Townsend, Mass 01470



KINGS

Coefficients covering the range of Basin's experiments are given in Table 53 (p. 5-15). Table 54 (p. 5-15) gives coefficients resulting from the experiments by the U.S. Deep Waterways Board.

For weirs of trapezoidal cross section with sloping upstream and vertical downstream face (Fig. 65) there are five series of

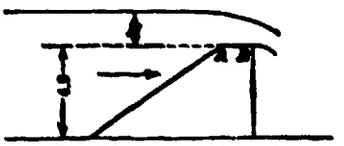


FIG. 65. Trapezoidal weir.

experiments by the U.S. Deep Waterways Board. All the models for these experiments were approximately 4.9 feet high, and the breadth of crest AB was either 0.33 or 0.66 foot. The length of all weirs was 6.58 feet.

Table 55 (p. 5-16) gives coefficients derived from these experiments. Discharges should be corrected for velocity of approach by formula (2) or (3).

Weirs of Irregular Section. Figures 66 to 70, inclusive, represent models of weirs experimented on by the U.S. Deep

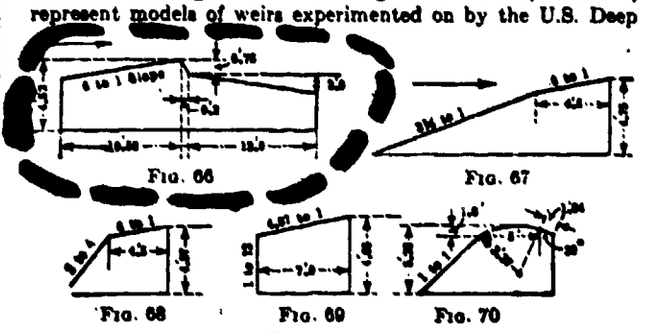


FIG. 66 FIG. 67

FIG. 68 FIG. 69 FIG. 70

FIGS. 66 to 70

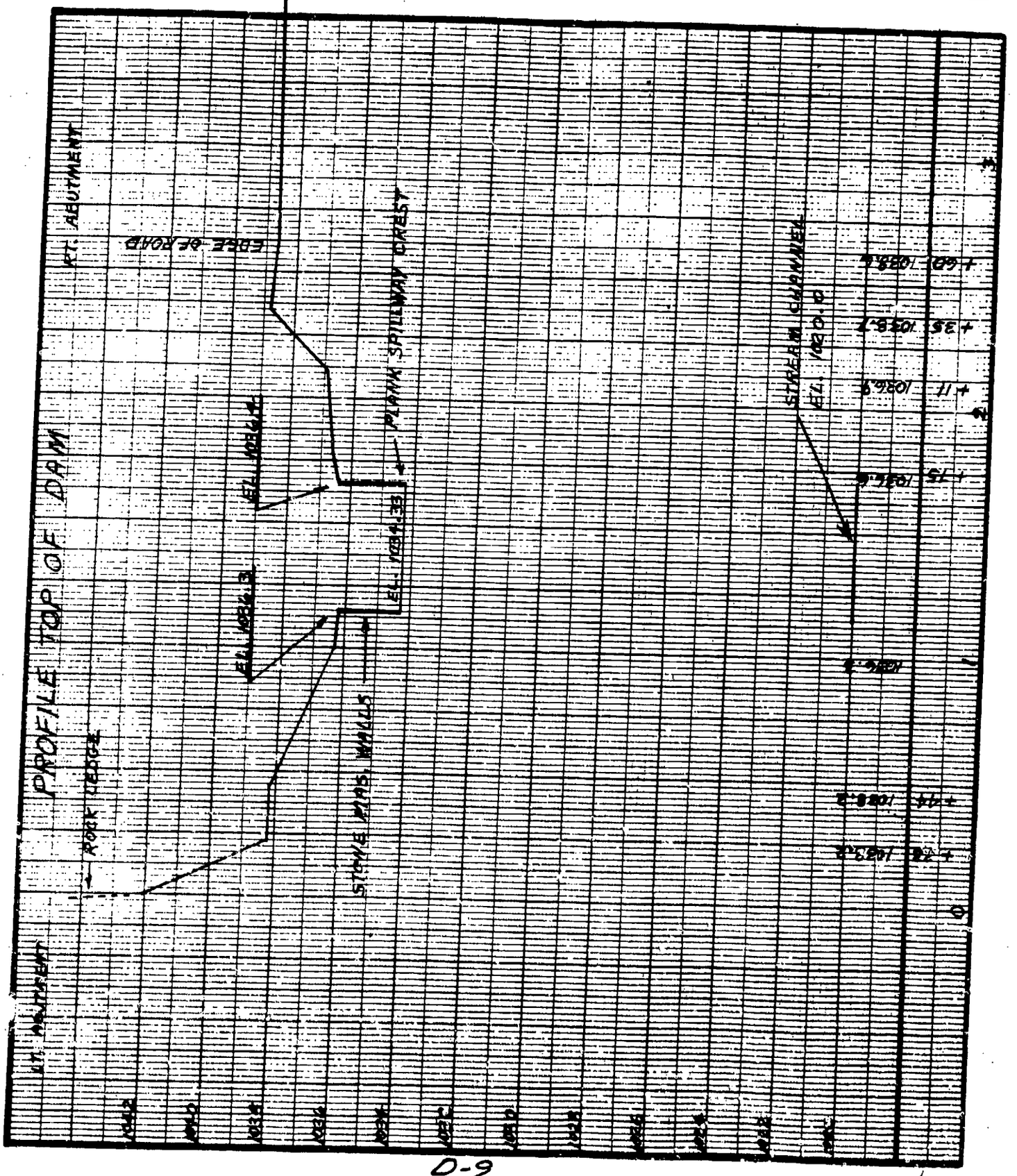
Waterways Board, under the direction of G. W. Rafter, at the hydraulic laboratory of Cornell University. From four to seven experiments were run on each model, the range of head varying approximately from 1 foot to 5.5 feet. Values of C tabulated from these experiments are given in Table 56 (p. 5-16).

Table 56. Values of C in the Formula $Q = CLH^{3/2}$ for Weirs of Irregular Cross Section

No. of figure	Head in feet, H									
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
66	3.13	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22
67	.....	3.41	3.38	3.30	3.3[illegible]	3.37	3.38	3.38	3.38	3.38
68	3.47	3.46	3.41	3.35	3.32	3.33	3.37	3.41	3.46	
69	.....	.....	.....	3.44	3.39	3.38	3.38	3.39	3.41	
70	3.38	3.39	3.32	3.39	3.46	3.51	3.59	3.62	3.65	

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

SHEET NO 1 OF 1
CALCULATED BY RJM DATE 6-2-81
CHECKED BY _____ DATE _____
SCALE HORZ 1" = 50' VERT. 1" = 4'



JOB GLENBURN POND DAM FA-0371

SHEET NO. _____ OF _____

CALCULATED BY MEH DATE _____

CHECKED BY _____ DATE _____

SCALE _____

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

STORAGE DATA

ELEV. (FT.)	AREA (Ac)	
1011.0	0	RESERVOIR BOT.
1034.3	25.7	NORMAL POOL
1036.3	39	LOW POINT TOP DAM
1040.0	64	CONTOUR

(1). ESTABLISH ELEV. @ 0 AREA

USE STORAGE PER BULLETIN 5 = 65 MG @ ELEV. 1034.3

$\Delta E. = {}^{33}/_{A} = {}^{(3)(199)}/25.7 = 23.2'$

ELEV. @ 0 AREA = 1034.3 - 23.2 = 1011.1

CALL 1011

FORM 204 Available from NEWS Inc. Townsend, Mass 01470

JOB GLENBURN POND DAM MA-0371

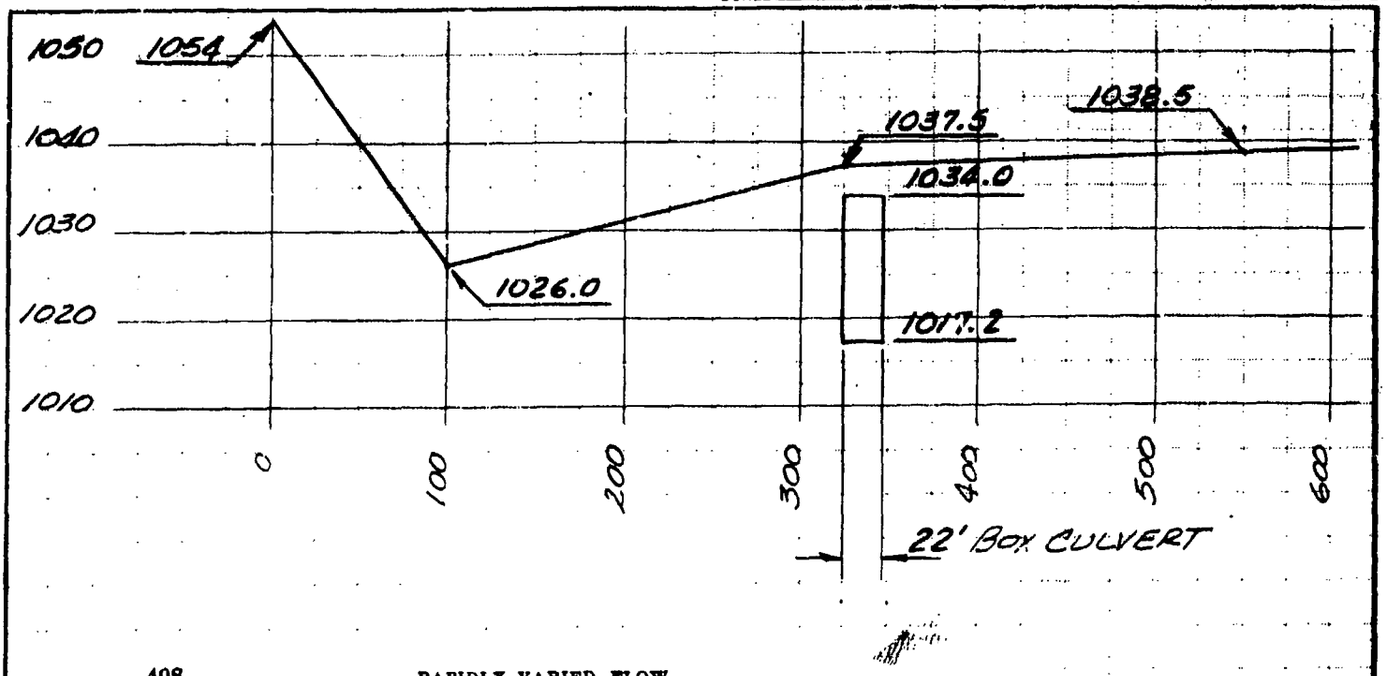
SHEET NO. _____ OF _____

CALCULATED BY WEH DATE 8/4/81

CHECKED BY _____ DATE _____

SCALE _____

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists



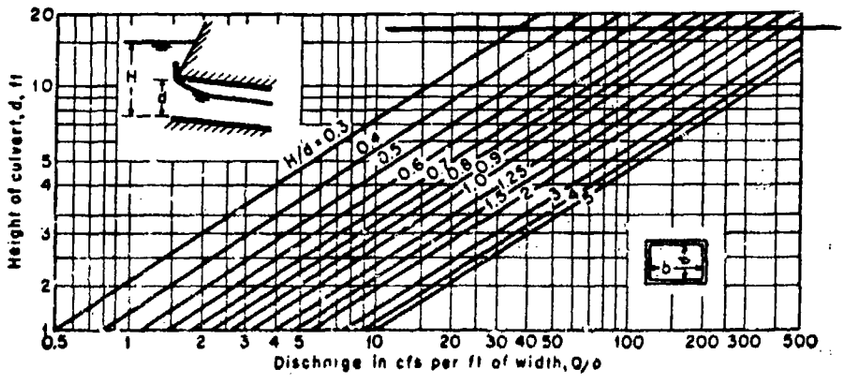


FIG. 17-29. Chart for estimating headwater on box culverts with square-edged entrances, flowing partly full. (*Based on data of U.S. Bureau of Public Roads* [29].)

REF: OPEN-CHANNEL HYDRAULICS (CHOW)

ESTIMATE CULVERT DISCHARGE USING CHART

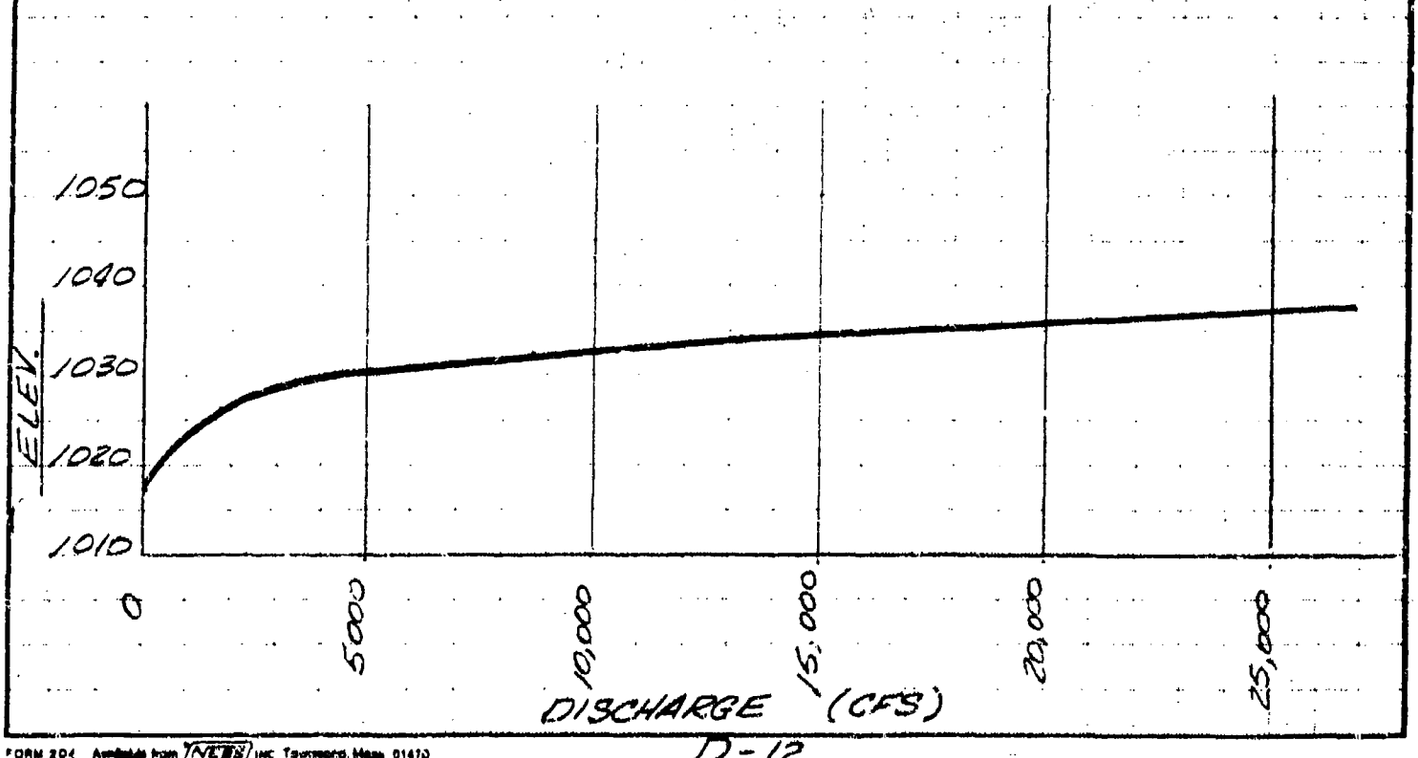
ESTIMATE OVERTOPPING BY CRITICAL DEPTH $Q_c = \left(32.2 A^3/T\right)^{1/2}$

FORM 224 Available from NEBS INC Townsend, Mass 01470

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB GLENBURN POND DAM PA-0371
SHEET NO. _____ OF _____
CALCULATED BY WEH DATE 8/4/81
CHECKED BY _____ DATE _____
SCALE _____

W.S. ELEV.	H	Q/b	Q1	A	T	Q2	QT
1017.2	0	0	0				0
1022.2	5.0	36	792				792
1023.9	6.7	55	1210				1210
1025.6	8.4	76	1672				1672
1026.0	8.8	80	1760	0	0	0	1760
1027.3	10.1	98	2156	20	30	89	2245
1029.0	11.8	130	2860	104	69	724	3584
1030.6	13.4	155	3410	245	106	2107	5517
1032.3	15.1	185	4070	459	146	4624	8694
1034.0	16.8	215	4730	740	185	8402	13,132
1037.5	20.3	275	6050	1530	266	20,817	26,867
1038.5	21.3	300	6600	1910	495	21,295	27,895



FORM 204 Available from NEES INC Townsend, Mass 01470

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

THE SELECTED SPILLWAY DESIGN FLOOD OF 0.5 PMF PRODUCES A RESERVOIR DISCHARGE OF 9561 CFS.

THE TAILWATER RATING CURVE INDICATES A TAILWATER ELEV. OF 1032.5, OR 1.8' BELOW SPILLWAY CREST & 3.8' BELOW THE LOW POINT TOP OF DAM.

ASSUME THAT TAILWATER HAS NO EFFECT ON FLOWS UP TO THE SDF, & CAN, THEREFORE BE ELIMINATED FROM THE ANALYSIS.

THE RESERVOIR DISCHARGE PASSES EITHER, THRU THE BOX CULVERT, OR OVER THE ROADWAY, & BACK TO THE STREAM CHANNEL. THE VOLUME OF STORAGE BETWEEN THE DAM & THE ROAD IS MINIMAL. THEREFORE, THE EFFECT OF THE ROAD & CULVERT ON THE ROUTING PROCEDURE IS NEGLIGIBLE, & THE FLOOD FLOWS CAN BE ROUTED DIRECTLY FROM THE DAM TO THE DOWNSTREAM HAZARD CENTER.

FORM 204 Available from NEES inc. Townsend, Mass 01470

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

JOB GLENBURN POND DAM
SHEET NO. _____ OF _____
CALCULATED BY WEH DATE 8/4/81
CHECKED BY _____ DATE _____
SCALE _____

STA	ELEV
0	1007
100	1001
300	998
303	995
318	995
321	998
333	1001
357	1007

REACH LENGTH = 2000'
SLOPE = 0.0125 ft/ft

STA	ELEV
0	993
150	992
350	988
356	982
376	982
388	988
888	988
908	993

REACH LENGTH = 1500'
SLOPE = 0.0087 ft/ft

FORM 304 Available from NEBS, INC. Townsend, Mass. 01470

GEO-TECHNICAL SERVICES
Consulting Engineers & Geologists

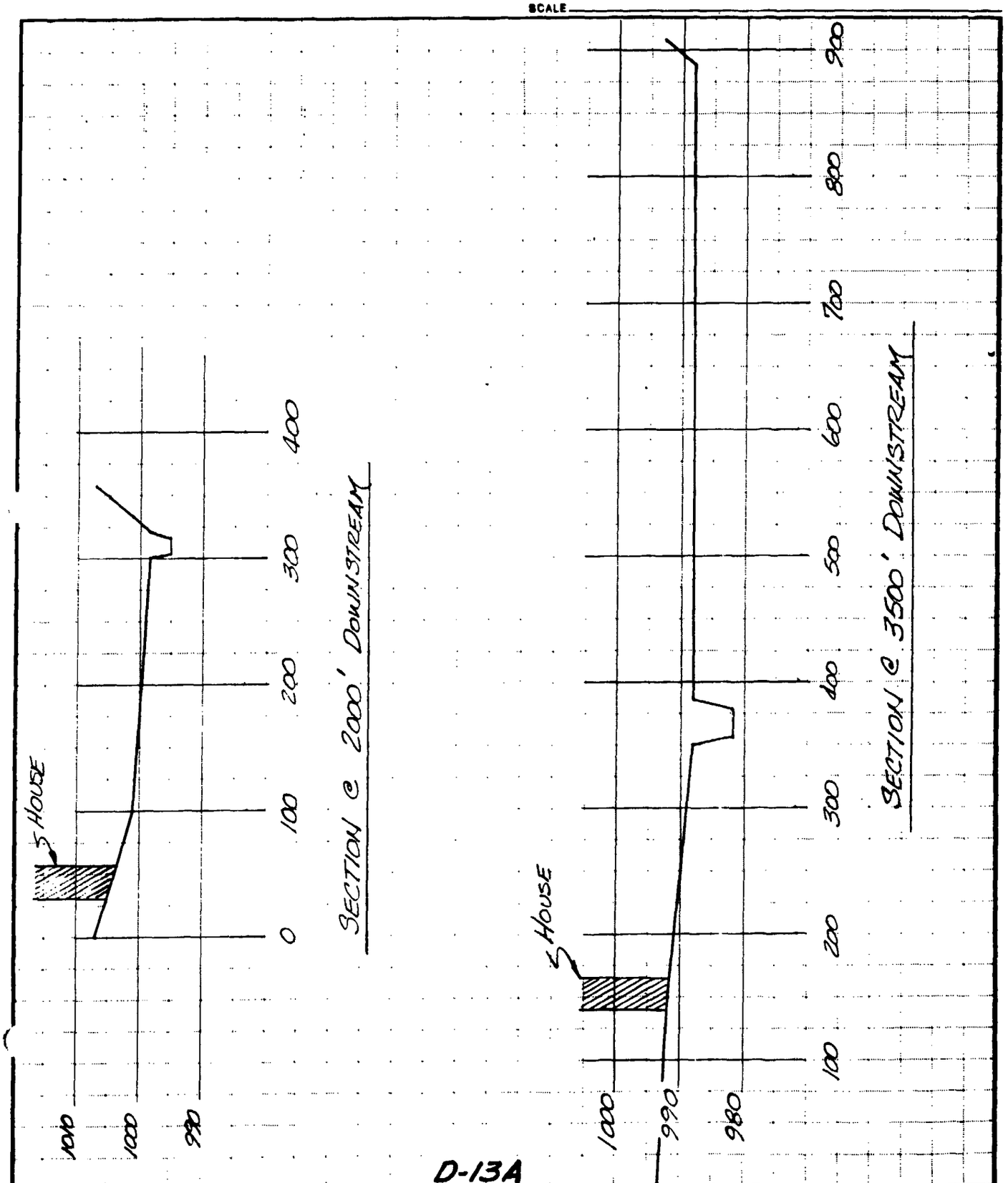
JOB GLENBURN POND DAM

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____



D-13A

FORM 204 Available from NEES Inc Townsend, Mass 01470

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                A1       NATIONAL DAM INSPECTION PROGRAM
    2                A2       GLENBURN POND DAM--PA-0371 (OVERTOPPING ANALYSIS)
    3                A3       GLENNPURN TWP., LACKAWANNA CO., PA
    4                B    150       0       15        0        0        0        0        0       -4        0
    5                B1     5       0        0        0        0        0        0        0        0        0
    6                J      1       7        1        0        0        0        0        0        0        0
    7                J1    .1      .2       .3       .4       .5      .75        1        0        0        0
    8                K      0       1        0        0        0        0        1        0        0        0
    9                K1       RUNOFF FROM SUB-AREA 1
   10                M      1       1      2.2        0      8.8        0        0        0        1        0
   11                P      0    21.3      118      127      136      142        0        0        0        0
   12                T      0       0        0        0        0        0        1      .05        0        0
   13                W  2.08     0.62        0        0        0        0        0        0        0        0
   14                X   -1.5     -.05        2        0        0        0        0        0        0        0
   15                K      0       1        0        0        0        0        1        0        0        0
   16                K1       RUNOFF FROM SUB-AREA 2
   17                M      1       1      6.6        0      8.8        0        0        0        1        0
   18                P      0    21.3      118      127      136      142        0        0        0        0
   19                T      0       0        0        0        0        0        1      .05        0      .04
   20                W  2.84     0.62        0        0        0        0        0        0        0        0
   21                X   -1.5     -.05        2        0        0        0        0        0        0        0
   22                K      2       1        0        0        0        0        1        0        0        0
   23                K1       INFLOW TO GLENBURN POND
   24                K      1       2        0        0        0        0        1        0        0        0
   25                K1       ROUTE THRU GLENBURN POND
   26                Y      0       0        0        1        1        0        0        0        0        0
   27                Y1     1       0        0        0        0        0 -1034.3       -1        0        0
   28                Y4 1034.3  1034.5   1035.0   1035.5   1036.3   1037.0   1038.0   1039.0   1040.0        0
   29                Y5     0      15       96      216      464      729     1169     1673     2235        0
   30                $A     0    25.7       39       64        0        0        0        0        0        0
   31                $E 1011.0  1034.3   1036.3   1040.0        0        0        0        0        0        0
   32                $$ 1034.3       0        0        0        0        0        0        0        0        0
   33                $D 1036.3     2.7      1.5      140        0        0        0        0        0        0
   34                $L     0      35       75      132      156      160      323      370        0        0
   35                $V 1036.3  1036.6   1036.9   1038.2   1038.3   1038.6   1038.8   1040.0        0        0
   36                K      1       3        0        0        0        0        1        0        0        0
   37                K1       ROUTE TO STREAM SECTION AT STA 3
   38                Y      0       0        0        1        1        0        0        0        0        0
   39                Y1     1       0        0        0        0        0        0        0        0        0
   40                Y6   .08     .04      .08      995     1020     2000   0.0125        0        0        0
   41                Y7     0    1007      100     1001      300      998      303      995      318      995
   42                Y7   321     998      333     1001      357     1007        0        0        0        0
   43                K      1       4        0        0        0        0        1        0        0        0
   44                K1       ROUTE TO STREAM SECTION AT STA 4
   45                Y      0       0        0        1        1        0        0        0        0        0
   46                Y1     1       0        0        0        0        0        0        0        0        0
   47                Y6   .08     .04      .08      982     1015     1500   0.0087        0        0        0
   48                Y7     0     993      150      992      350      988      356      982      376      982
   49                Y7   388     988      888      984      908      993        0        0        0        0
   50                K     99       0        0        0        0        0        0        0        0        0
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D-14

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE= 81/08/04.
     TIME= 12.28.14.
```

NATIONAL DAM INSPECTION PROGRAM
GLENPURN POND DAM--PA-3371 (OVERTOPPING ANALYSIS)
GLENNBURN TWP., LACKAWANNA CO., PA

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 7 LRTIO= 1

RTIOS= .10 .20 .30 .40 .50 .75 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

RUNOFF FROM SUB-AREA 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.20	0.00	8.80	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.30	118.00	127.00	136.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .500

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.08 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 46 END-OF-PERIOD ORDINATES, LAG= 2.06 HOURS, CP= .63 VOL= 1.00

17.	64.	128.	201.	278.	349.	401.	431.	437.	412.
365.	320.	281.	246.	216.	189.	166.	145.	127.	112.
98.	86.	75.	66.	58.	51.	44.	39.	34.	30.

26.	23.	20.	18.	15.	14.	12.	10.	9.	8.	
7.	6.	5.	5.	4.	4.					

0

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.20	21.97	2.22	120517.
										(615.)(	558.)(	56.)(	3412.66)

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

RUNOFF FROM SUB-AREA 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.60	0.00	8.80	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.50	118.00	127.00	136.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
2	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	.04

UNIT HYDROGRAPH DATA

TP= 2.84 CP= .62 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG= 2.82 HOURS, CP= .63 VOL= 1.00

25.	93.	190.	302.	424.	553.	681.	794.	879.	938.
969.	969.	925.	848.	771.	700.	636.	578.	525.	477.
434.	394.	358.	325.	296.	269.	244.	222.	202.	183.
166.	151.	137.	125.	114.	103.	94.	85.	77.	70.
64.	58.	53.	48.	44.	40.	36.	33.	30.	27.
25.	22.	20.	18.	17.	15.	14.	13.	11.	10.
	9.								

0

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.20	22.06	2.13	305135.
										(615.)(	560.)(	54.)(	9773.13)

********** ********** ********** ********** **********

9/10

COMBINE HYDROGRAPHS

INFLOW TO GLENBURN POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	2	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THRU GLENBURN POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1034.	-1

STAGE	1034.30	1034.50	1035.00	1035.50	1036.30	1037.00	1038.00	1039.00	1040.00
FLOW	0.00	15.00	96.00	216.00	464.00	729.00	1169.00	1675.00	2235.00
SURFACE AREA=	0.	26.	39.	64.					
CAPACITY=	0.	200.	264.	452.					
ELEVATION=	1011.	1034.	1036.	1040.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1034.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1036.3	2.7	1.5	140.

CREST LENGTH AT OR BELOW ELEVATION	0.	35.	75.	132.	156.	160.	323.	370.
	1036.3	1036.6	1036.9	1038.2	1038.3	1038.6	1038.8	1040.0

PEAK OUTFLOW IS 1849. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 3806. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 5729. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 7646. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 9561. AT TIME 42.50 HOURS

D-17

PEAK OUTFLOW IS 14345. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 19124. AT TIME 42.50 HOURS

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO STREAM SECTION AT STA 3

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	995.0	1020.0	2000.	.01250

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1007.00 100.00 1001.00 300.00 998.00 303.00 995.00 318.00 995.00
321.00 998.00 333.00 1001.00 357.00 1007.00

STORAGE	0.00	.99	2.13	4.85	12.97	26.32	41.95	59.21	78.11	98.66
	120.22	141.79	163.35	184.92	206.49	228.06	249.62	271.19	292.76	314.33
OUTFLOW	0.00	97.95	313.60	700.88	1530.78	3134.85	5603.91	8811.24	12758.73	17461.22
	23553.46	30498.81	38172.67	46541.15	55575.97	65253.00	75551.31	86452.50	97940.16	109999.55
STAGE	995.00	996.32	997.63	998.95	1000.26	1001.58	1002.89	1004.21	1005.53	1006.84
	1008.16	1009.47	1010.79	1012.11	1013.42	1014.74	1016.05	1017.37	1018.68	1020.00
FLOW	0.00	97.95	313.60	700.88	1530.78	3134.85	5603.91	8811.24	12758.73	17461.22
	23553.46	30498.81	38172.67	46541.15	55575.97	65253.00	75551.31	86452.50	97940.16	109999.55

MAXIMUM STAGE IS 1000.5

MAXIMUM STAGE IS 1001.9

MAXIMUM STAGE IS 1002.9

MAXIMUM STAGE IS 1003.7

MAXIMUM STAGE IS 1004.9

MAXIMUM STAGE IS 1006.0

MAXIMUM STAGE IS 1007.2

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO STREAM SECTION AT STA 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	982.0	1015.0	1590.	.00870

61-D

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 993.00 150.00 992.00 350.00 988.00 356.00 982.00 376.00 982.00
388.00 988.00 888.00 988.00 908.00 993.00

STORAGE	0.00	1.35	3.02	4.99	24.38	62.42	106.37	159.79	214.18	268.48
	322.71	377.02	431.32	485.63	539.94	594.24	648.55	702.85	757.16	811.47
OUTFLOW	0.00	178.00	587.02	1207.77	2955.13	8267.94	16538.82	28632.43	44353.28	62993.47
	84324.99	108180.11	134427.56	162960.29	193688.48	226535.14	261433.18	298323.36	337152.79	377873.82
STAGE	982.00	983.74	985.47	987.21	988.95	990.68	992.42	994.16	995.89	997.63
	999.37	1001.11	1002.84	1004.58	1006.32	1008.05	1009.79	1011.53	1013.26	1015.00
FLOW	0.00	178.00	587.02	1207.77	2955.13	8267.94	16538.82	28632.43	44353.28	62993.47
	84324.99	108180.11	134427.56	162960.29	193688.48	226535.14	261433.18	298323.36	337152.79	377873.82

MAXIMUM STAGE IS 987.8

MAXIMUM STAGE IS 989.2

MAXIMUM STAGE IS 989.8

MAXIMUM STAGE IS 990.5

MAXIMUM STAGE IS 991.0

MAXIMUM STAGE IS 992.0

MAXIMUM STAGE IS 992.8

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS						
				RATIO 1 .10	RATIO 2 .20	RATIO 3 .30	RATIO 4 .40	RATIO 5 .50	RATIO 6 .75	RATIO 7 1.00
HYDROGRAPH AT	1	2.20	1	555.	1109.	1664.	2219.	2774.	4160.	5547.
		(5.70)		(15.71)(	31.41)(	47.12)(	62.83)(	78.54)(	117.81)(	157.07)(
HYDROGRAPH AT	1	6.60	1	1409.	2818.	4227.	5636.	7045.	10567.	14089.
		(17.09)		(39.90)(	79.79)(	119.69)(	159.59)(	199.48)(	299.22)(	398.97)(
2 COMBINED	1	8.80	1	1927.	3853.	5780.	7707.	9634.	14451.	19267.
		(22.79)		(54.56)(	109.12)(	163.68)(	218.24)(	272.80)(	409.20)(	545.59)(
ROUTED TO	2	8.80	1	1849.	3806.	5729.	7646.	9561.	14345.	19124.
		(22.79)		(52.36)(	107.78)(	162.24)(	216.52)(	270.74)(	406.20)(	541.54)(
ROUTED TO	3	8.80	1	1843.	3799.	5728.	7645.	9562.	14347.	19131.
		(22.79)		(52.19)(	107.59)(	162.19)(	216.49)(	270.77)(	406.27)(	541.72)(
ROUTED TO	4	8.80	1	1842.	3797.	5713.	7630.	9552.	14337.	19118.
		(22.79)		(52.17)(	107.52)(	161.77)(	216.05)(	270.47)(	405.97)(	541.36)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1034.30	1034.30	1036.30
STORAGE	200.	200.	264.
OUTFLOW	0.	0.	464.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1038.21	1.91	350.	1849.	8.50	42.75	0.00
.20	1039.39	3.09	415.	3806.	9.75	42.50	0.00
.30	1040.13	3.83	461.	5729.	10.25	42.50	0.00
.40	1040.75	4.45	502.	7646.	10.75	42.50	0.00
.50	1041.30	5.00	543.	9561.	11.75	42.50	0.00
.75	1042.54	6.24	641.	14345.	14.00	42.50	0.00
1.00	1043.64	7.34	740.	19124.	15.00	42.50	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1843.	1000.5	42.75
.20	3799.	1001.9	42.50
.30	5728.	1002.9	42.50
.40	7645.	1003.7	42.50
.50	9562.	1004.5	42.50
.75	14347.	1006.0	42.50
1.00	19131.	1007.2	42.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1842.	987.8	43.00
.20	3797.	989.2	42.75
.30	5713.	989.8	42.50
.40	7630.	990.5	42.50
.50	9552.	991.0	42.50
.75	14337.	992.0	42.50
1.00	19118.	992.8	42.50

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********
    1                A1       NATIONAL DAM INSPECTION PROGRAM
    2                A2       GLENBURN POND DAM--PA-0571 (BREACH ANALYSIS)
    3                A3       GLENBURN TWP., LACKAWANNA CO., PA
    4                B     150        0       15        0        0        0        0        0       -4        0
    5                B1      5        0        0        0        0        0        0        0        0        0
    6                J       8        2        1        0        0        0        0        0        0        0
    7                J1     .1       .5        3        0        0        0        0        0        0        0
    8                K       0        1        3        0        0        0        1        0        0        0
    9                K1       RUNOFF FROM SUB-AREA 1
   10                M       1        1      2.2        0      8.8        0        0        0        1        0
   11                P       0     21.3      118      127      136      142        0        0        0        0
   12                T       0        0        0        0        0        0        1      .05        0        0
   13                W    2.08     0.62        0        0        0        0        0        0        0        0
   14                X    -1.5     -.05        2        0        0        0        0        0        0        0
   15                K       0        1        3        0        0        0        1        0        0        0
   16                K1       RUNOFF FROM SUB-AREA 2
   17                M       1        1      6.6        0      8.8        0        0        0        1        0
   18                P       0     21.3      118      127      136      142        0        0        0        0
   19                T       0        0        0        0        0        0        1      .05        0      .05
   20                W    2.84     0.62        0        0        0        0        0        0        0        0
   21                X    -1.5     -.05        2        0        0        0        0        0        0        0
   22                K       2        1        0        0        0        0        1        0        0        0
   23                K1       INFLOW TO GLENBURN POND
   24                K       1        2        0        0        0        0        1        0        0        0
   25                K1       ROUTE THRU GLENBURN POND
   26                Y       0        0        0        1        1        0        0        0        0        0
   27                Y1      1        0        0        0        0        0  -1034.3       -1        0        0
   28                Y4 1034.3  1034.5  1035.0  1035.5  1036.3  1037.0  1038.0  1039.0  1040.0        0
   29                Y5      0       15       96      216      464      729     1169     1673     2235        0
   30                $A      0     25.7       39       64        0        0        0        0        0        0
   31                $E 1011.0  1034.3  1036.3  1040.0        0        0        0        0        0        0
   32                $S 1034.3        0        0        0        0        0        0        0        0        0
   33                $D 1036.3      2.7      1.5      140        0        0        0        0        0        0
   34                $L      0       35       75      132      156      160      323      370        0        0
   35                $V 1036.3  1036.6  1036.9  1038.2  1038.3  1038.6  1038.8  1040.0        0        0
   36                $B     30        1     1620      .25  1034.3  1037.3        0        0        0        0
   37                $B     30        1     1026      .25  1034.3  1037.3        0        0        0        0
   38                $B     50        1     1020      .25  1034.3  1037.3        0        0        0        0
   39                $B     50        1     1026      .25  1034.3  1037.3        0        0        0        0
   40                K       1        3        0        0        0        0        1        0        0        0
   41                K1       ROUTE TO STREAM SECTION AT STA 3
   42                Y       0        0        0        1        1        0        0        0        0        0
   43                Y1      1        0        0        0        0        0        0        0        0        0
   44                Y6    .08      .04      .08      995     1020     2000   0.0125        0        0        0
   45                Y7      0     1007      100     1001      300      998      303      995      318      995
   46                Y7    321      998      333     1001      357     1007        0        0        0        0
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K      1       4       0       0       0       0       1       0       0       0
K1      ROUTE TO STREAM SECTION AT STA 4
Y      0       0       0       1       1       0       0       0       0       0
Y1     1       0       0       0       0       0       0       0       0       0
Y6   .08     .04     .08     982    1015    1500  0.0087       0       0       0
Y7     0     993     150     992     350     988     356     982     376     982
Y7   388     988     888     988     988     993       0       0       0       0
K     99       0       0       0       0       0       0       0       0       0
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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********************************

RUN  DATE= 81/08/04.
     TIME= 13.16.06.
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NATIONAL DAM INSPECTION PROGRAM
GLENBURN POND DAM--PA-0371 (BREACH ANALYSIS)
GLENNBURN TWP., LACKAWANNA CO., PA

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 4 NRTIO= 2 LRTIO= 1

RTIOS= .10 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

RUNOFF FROM SUB-AREA 1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.20	0.00	8.80	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.30	118.00	127.00	136.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .808

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 2.08 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 46 END-OF-PERIOD ORDINATES, LAG= 2.06 HOURS, CP= .63 VOL= 1.00

17.	64.	128.	201.	278.	349.	401.	431.	437.	412.
365.	320.	281.	246.	216.	189.	165.	145.	127.	112.
98.	86.	75.	66.	58.	51.	44.	39.	34.	30.

26.	23.	20.	18.	15.	14.	12.	10.	9.	8.
7.	6.	5.	5.	4.	4.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.20	21.97	2.22	120517.
										(615.)	(558.)	(56.)	(3412.66)

****

SUB-AREA RUNOFF COMPUTATION

RUNOFF FROM SUB-AREA 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	6.60	0.00	8.80	0.90	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	21.30	116.00	127.00	136.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .900

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	.04

D-25

UNIT HYDROGRAPH DATA

TP= 2.84 CP= .62 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG= 2.82 HOURS, CP= .63 VOL= 1.00

25.	93.	190.	302.	424.	553.	681.	794.	879.	938.
969.	969.	925.	848.	771.	700.	636.	578.	525.	477.
434.	394.	358.	325.	296.	269.	244.	222.	202.	183.
166.	151.	137.	125.	114.	103.	94.	85.	77.	70.
64.	58.	53.	48.	44.	40.	36.	33.	30.	27.
25.	22.	20.	18.	17.	15.	14.	13.	11.	10.
9.	9.								

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	24.20	22.06	2.13	345135.
										(615.)	(560.)	(54.)	(9773.13)

****

COMBINE HYDROGRAPHS

INFLOW TO GLENBURN POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	2	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

ROUTE THRU GLENBURN POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1034.	-1

STAGE	1034.30	1034.50	1035.00	1035.50	1036.30	1037.00	1038.00	1039.00	1040.00
FLOW	0.00	15.00	96.00	216.00	464.00	729.00	1169.00	1673.00	2235.00
SURFACE AREA=	0.	26.	39.	64.					
CAPACITY=	0.	200.	264.	452.					
ELEVATION=	1011.	1034.	1036.	1040.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1034.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1036.3	2.7	1.5	140.

CREST LENGTH AT OR BELOW ELEVATION	0.	35.	75.	132.	156.	160.	323.	370.
	1036.3	1036.6	1036.9	1038.2	1038.3	1038.6	1038.8	1040.0

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
30.	3.00	1020.00	.25	1034.30	1037.30

BEGIN DAM FAILURE AT 41.00 HOURS

PEAK OUTFLOW IS 9382. AT TIME 41.25 HOURS

BEGIN DAM FAILURE AT 38.00 HOURS

PEAK OUTFLOW IS 9493. AT TIME 42.50 HOURS

92-D

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
30.	1.00	1026.00	.25	1034.30	1037.30

BEGIN DAM FAILURE AT 41.00 HOURS

PEAK OUTFLOW IS 5217. AT TIME 41.25 HOURS

BEGIN DAM FAILURE AT 38.00 HOURS

PEAK OUTFLOW IS 9552. AT TIME 42.50 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	1.00	1020.00	.25	1034.30	1037.30

BEGIN DAM FAILURE AT 41.00 HOURS

PEAK OUTFLOW IS 12526. AT TIME 41.25 HOURS

BEGIN DAM FAILURE AT 38.00 HOURS

PEAK OUTFLOW IS 12506. AT TIME 38.25 HOURS

0.27

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	1.00	1026.00	.25	1034.30	1037.30

BEGIN DAM FAILURE AT 41.00 HOURS

PEAK OUTFLOW IS 7080. AT TIME 41.25 HOURS

BEGIN DAM FAILURE AT 38.00 HOURS

PEAK OUTFLOW IS 9494. AT TIME 42.50 HOURS

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HYDROGRAPH ROUTING

ROUTE TO STREAM SECTION AT STA 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	995.0	1020.0	2000.	.01250

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1007.00 100.00 1001.00 300.00 998.00 303.00 995.00 318.00 995.00
321.00 998.00 333.00 1001.00 357.00 1007.00

STORAGE	0.00	.99	2.13	4.85	12.97	26.32	41.95	59.21	78.11	98.66
	120.22	141.79	163.35	184.92	206.49	228.06	249.62	271.19	292.76	314.33
OUTFLOW	0.00	97.95	313.60	700.88	1530.78	3134.85	5603.91	8811.24	12758.73	17461.22
	23553.46	30498.81	38172.67	46541.15	55575.97	65253.00	75551.31	86452.50	97940.16	109999.55
STAGE	995.00	996.32	997.63	998.95	1000.26	1001.58	1002.89	1004.21	1005.53	1006.84
	1008.16	1009.47	1010.79	1012.11	1013.42	1014.74	1016.05	1017.37	1018.68	1020.00
FLOW	0.00	97.95	313.60	700.88	1530.78	3134.85	5603.91	8811.24	12758.73	17461.22
	23553.46	30498.81	38172.67	46541.15	55575.97	65253.00	75551.31	86452.50	97940.16	109999.55

MAXIMUM STAGE IS 1003.8

MAXIMUM STAGE IS 1004.4

MAXIMUM STAGE IS 1002.5

MAXIMUM STAGE IS 1004.5

MAXIMUM STAGE IS 1004.4

MAXIMUM STAGE IS 1004.5

MAXIMUM STAGE IS 1003.1

MAXIMUM STAGE IS 1004.4

42-0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO STREAM SECTION AT STA 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0
NSTPS	**NSTDL**	**LAG**	**AMSKK**	**X**	**TSK**	**STORA**	**ISPRAT**	
1	0	0	0.000	0.000	0.000	0.	0	

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0400	.0800	982.0	1015.0	1500.	.00870

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 993.00 150.00 992.00 350.00 988.00 356.00 982.00 376.00 982.00
388.00 988.00 888.00 988.00 908.00 993.00

STORAGE	0.00	1.35	3.02	4.99	24.38	62.42	106.37	159.79	214.18	268.48
	322.71	377.02	431.32	485.63	539.94	594.24	648.55	702.85	757.16	811.47
OUTFLOW	0.00	178.00	587.02	1207.77	2955.13	8267.94	16538.02	28632.43	44353.26	62993.47
	84324.99	108180.11	134427.56	162960.29	193688.48	226535.14	261433.18	298323.36	337152.79	377873.82
STAGE	982.00	983.74	985.47	987.21	988.95	990.68	992.42	994.16	995.89	997.63
	999.37	1001.11	1002.84	1004.58	1006.32	1008.05	1009.79	1011.53	1013.26	1015.00
FLOW	0.00	178.00	587.02	1207.77	2955.13	8267.94	16538.02	28632.43	44353.26	62993.47
	84324.99	108180.11	134427.56	162960.29	193688.48	226535.14	261433.18	298323.36	337152.79	377873.82

MAXIMUM STAGE IS 990.4

MAXIMUM STAGE IS 990.9

MAXIMUM STAGE IS 989.4

MAXIMUM STAGE IS 991.0

MAXIMUM STAGE IS 991.0

MAXIMUM STAGE IS 991.0

MAXIMUM STAGE IS 989.8

MAXIMUM STAGE IS 990.9

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .50
HYDROGRAPH AT	1	2.20	1	555.	2774.
		(5.70)		(15.71)(	78.54)(
			2	555.	2774.
				(15.71)(	78.54)(
			3	555.	2774.
				(15.71)(	78.54)(
			4	555.	2774.
				(15.71)(	78.54)(
HYDROGRAPH AT	1	6.66	1	1409.	7045.
		(17.09)		(39.90)(	199.48)(
			2	1409.	7045.
				(39.90)(	199.48)(
			3	1409.	7045.
				(39.90)(	199.48)(
			4	1409.	7045.
				(39.90)(	199.48)(
2 COMBINED	1	8.80	1	1927.	9634.
		(22.79)		(54.56)(	272.80)(
			2	1927.	9634.
				(54.56)(	272.80)(
			3	1927.	9634.
				(54.56)(	272.80)(
			4	1927.	9634.
				(54.56)(	272.80)(

ROUTED TO	2	8.80	1	9382.	9493.
	(	22.79)	(	265.66)(	268.81)(
			2	5217.	9552.
			(	147.73)(	270.47)(
			3	12526.	12506.
			(	354.68)(	354.13)(
			4	7080.	9494.
			(	200.50)(	268.85)(
ROUTED TO	3	8.80	1	7881.	9481.
	(	22.79)	(	223.17)(	268.46)(
			2	4773.	9550.
			(	135.17)(	270.42)(
			3	9403.	9622.
			(	266.26)(	272.47)(
			4	6039.	9481.
ROUTED TO	4	8.80	1	7542.	9477.
	(	22.79)	(	213.57)(	268.35)(
			2	4260.	9536.
			(	120.62)(	270.04)(
			3	9579.	9685.
			(	271.25)(	274.26)(
			4	5714.	9476.
			(	161.80)(	268.34)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1034.30	1034.30	1036.30
STORAGE	200.	200.	264.
OUTFLOW	0.	0.	464.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1037.51	1.21	316.	9382.	1.76	41.25	41.00
.50	1037.41	1.11	311.	9493.	3.26	42.50	38.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1034.30	1034.30	1036.30
STORAGE	200.	200.	264.
OUTFLOW	0.	0.	464.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1037.53	1.23	316.	5217.	1.88	41.25	41.00
.50	1039.53	3.23	423.	9552.	7.30	42.50	38.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1034.30	1034.30	1036.30
STORAGE	200.	200.	264.
OUTFLOW	0.	0.	464.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1037.51	1.21	315.	12526.	1.73	41.25	41.00
.50	1037.40	1.10	310.	12506.	1.98	38.25	38.00

PLAN 4 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1034.30	1034.30	1036.30
STORAGE	200.	200.	264.
OUTFLOW	0.	0.	464.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1037.52	1.22	316.	7080.	1.80	41.25	41.00
.50	1038.36	2.06	357.	9494.	5.80	42.50	38.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	7861.	1003.8	41.50
.50	9481.	1004.4	42.50

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	4773.	1002.5	41.50
.50	9550.	1004.5	42.50

PLAN 3 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	9403.	1004.4	41.50
.50	9622.	1004.5	38.50

PLAN 4 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	6039.	1003.1	41.50
.50	9481.	1004.4	42.50

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	7542.	990.4	41.50
.50	9477.	990.9	42.75

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	4260.	989.4	41.50
.50	9536.	991.0	42.50

PLAN 3 STATION 4

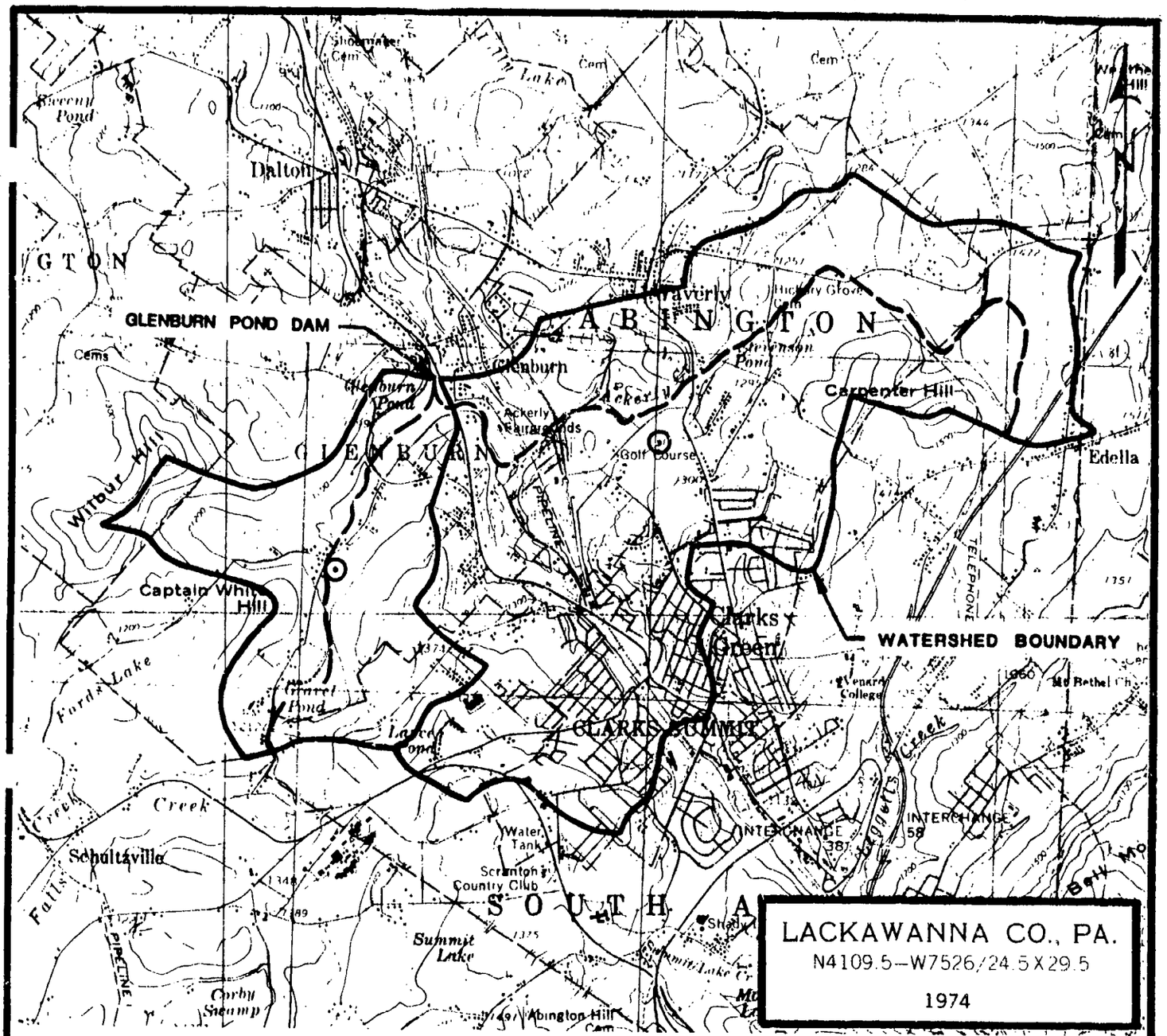
RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	9579.	991.0	41.50
.50	9685.	991.0	38.50

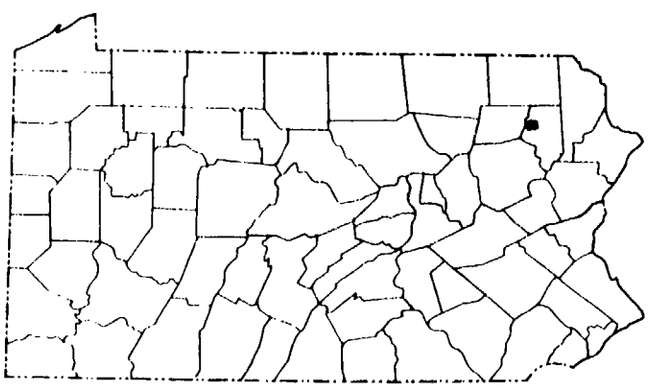
PLAN 4 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	5714.	989.9	41.50
.50	9476.	990.9	42.75

APPENDIX E

EXHIBITS





LONGEST WATERCOURSE

CENTROID OF DRAINAGE AREA

EXHIBIT E-1

REGIONAL VICINITY AND WATERSHED BOUNDARY MAP

1. (1914 PHOTO) ICE HOUSE ON LEFT OF ABUTMENT

2. (1914 PHOTO) VIEW OF TEMPORARY SUPPORT OF RIGHT DRY STONE WALL

3. (1924 PHOTO) VIEW OF DOWNSTREAM BULGE OF RIGHT DRY STONE WALL

4. (1926 PHOTO) VIEW OF REPAIRS TO RIGHT DRY STONE WALL
NOTE SLUICEWAY OPENING (NOW CLOSED OFF)

5. (1927 PHOTO) VIEW OF COMPLETED DRY STONE BUTTRESS TO SUPPORT RIGHT DRY STONE WALL

6. (1956 PHOTO) VIEW OF LEAKAGE THRU DRY STONE WALL UNDER SPILLWAY

APPENDIX F

GEOLOGY

GLENBURN POND DAM

APPENDIX F

GEOLOGY

The Glenburn Pond Dam and reservoir are located within the Glaciated Allegheny Plateau Section of the Appalachian Plateau Physiographic Province. The site is about 12 miles northwest of the axis of the Northern Anthracite Coal Field of Pennsylvania. Except where bedrock is exposed, deposits of glacial drift of variable thickness cover the entire area. The drift was deposited by the Wisconsin Ice Sheet during the Pleistocene period of geologic time.

The glacial drift is composed primarily of till which is a reddish-brown, unsorted, compact mixture of clay, silt, sand, gravel, and cobbles with occasional boulder size pieces. The stone pieces are sub-angular to rounded and consist mainly of sandstone and siltstone derived from the Catskill Formation, the dominant rock formation in the area. The clay content and compact nature of the till makes it a relatively impervious soil type. The right abutment of the dam is underlain by such till.

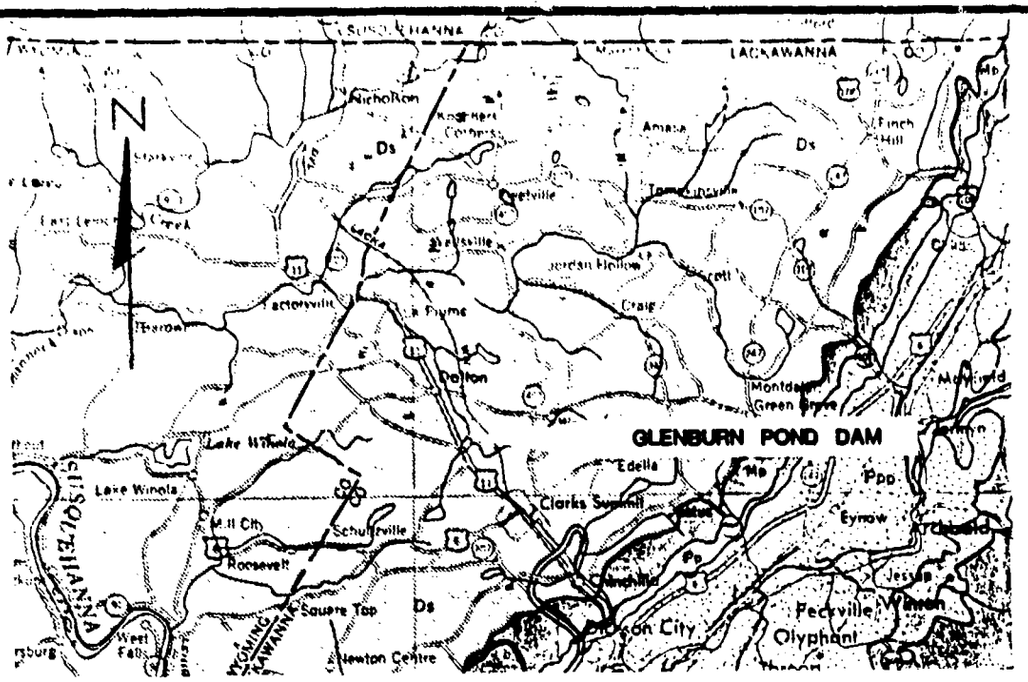
Some deposits of glacial outwash and Kame terraces are also found in the area. These deposits are composed of loose, poorly sorted to stratified deposits of silt, sand, and gravel. The Kame and outwash deposits are generally very pervious.

Other loose pervious soils in the area are the recent deposits of alluvial silt, sand, and gravel with some clay. These soils are localized and limited to streambeds and flood plains such as the marsh southeast of the lake.

The bedrock underlying the entire dam and reservoir area is the Catskill Formation of the Susquehanna Group. This group of formations is of Upper Devonian age. The Catskill strata generally consists of well indurated, red shale, siltstone and fine sandstone layers. Occasional gray, green, and brown shale, siltstone and sandstone, as well as conglomeratic layers are encountered. The red shales are the dominant lithology and the residual soils derived from this rock are usually high in clay and silt. The downstream wall and buttresses were built with Catskill boulders.

The regional structure of the bedrock in the area indicates that the bedrock underlying the dam and reservoir area is gently folded. A ten to fifteen foot excavated bedrock face near the dam is composed of red and gray shale and fine sandstone which strikes $N45^{\circ}E$ and dips $12^{\circ}NW$.

Ref.: Ground Water of Northeastern Pennsylvania, Stanley W. Lohman, 1937; Bulletin W-4, Pennsylvania Geologic Survey.



SCALE: 1" = 4 MILES

LEGEND

PENNSYLVANIAN

ANTHRACITE REGION

Ppp — **Post-Pottsville Formations**
Brown or gray sandstones and shales with some conglomerate and numerous mineable coals.

Pp — **Pottsville Group**
Light gray to white, coarse grained sandstones and conglomerates with some mineable coal, includes Sharp Mountain, Schuylkill, and Tumbling Run Formations.

MISSISSIPPIAN

Mmc — **Mauch Chunk Formation**
Red shales with brown to greenish gray Buffalo sandstones, includes Greenbrier Limestone in Fayette, Westmoreland, and Somerset counties. Loyalhanna Limestone at the base in southwestern Pennsylvania.

Mp — **Pocono Group**
Predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale, includes in the Appalachian Plateau Region Shenango, Cuyahoga, Cussewago, Corry, and Knapp Formations, includes part of "Oswayo" of A. J. Eaton in Potter and Tioga counties.

DEVONIAN

UPPER

CENTRAL AND EASTERN PENNSYLVANIA

Dos — **Oswayo Formation**
Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses, includes red shales which become more numerous eastward. Relation to type Oswayo not proved.

Dck — **Catskill Formation**
Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

Dm — **Marine beds**
Gray to olive brown shales, graywackes, and sandstones contains "Chemung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmers Rock. Tully Limestone at base.

Ds — **Susquehanna Group**
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports, barbs on "Chemung" side of line.

NOTE:
GEOLOGIC MAP AND LEGEND OBTAINED FROM GEOLOGIC MAP OF PENNSYLVANIA BY PA. TOPOGRAPHIC AND GEOLOGIC SURVEY, DATED 1980

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

GLENBURN POND DAM
GEOLOGIC MAP

GEO - Technical Services, Inc.
HARRISBURG, PA

JUNE, 1981

EXHIBIT F